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ANNUAL REPORT

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OF THE

UNIV. OF MICH.
FEB 26 1908

State Engineer and Surveyor

ON THE

CANALS OF NEW YORK,

For the Year 1870.

TRANSMITTED TO THE LEGISLATURE JANUARY 13, 1871.

ALBANY:
THE ARGUS COMPANY, PRINTERS.
1871.

EPORT

and Surveyor

THE

OF NEW YORK,

For the Year **1870.**

SMITTED TO THE LEGISLATURE JANUARY 13, 1871.

ALBANY:
THE ARGUS COMPANY, PRINTERS.
1871.

STATE OF NEW YORK.

No. 19.

IN ASSEMBLY,

January 13, 1871.

ANNUAL REPORT

OF THE STATE ENGINEER AND SURVEYOR ON THE NEW YORK STATE CANALS FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1870.

Office of the State Engineer and Surveyor,
Albany, *January* 13, 1871.

Hon. William Hitchman,
Speaker of the Assembly:

Sir.—I have the honor to transmit herewith, to the Legislature, my annual report on the canals of the State, for the year ending September 30, 1870.

Yours, very respectfully,

VAN R. RICHMOND,
State Engineer and Surveyor.

REPORT.

Office of the State Engineer and Surveyor,
Albany, *January* 13, 1871.

To the Honorable the Legislature of the State of New York:

The State Engineer and Surveyor, in obedience to the requirements of act, chap. 777, Laws of 1850, has the honor to submit herewith his annual report for the fiscal year ending September 30, 1870.

ENGINEER DEPARTMENT.

Act, chap. 477, Laws of 1865, authorizes the appointment, by the Canal Board, of three Division and three Resident Engineers; and act, chap. 794, Laws of 1866, authorizes the appointment of an additional Resident Engineer in charge of the Chenango canal extension. The existing laws, therefore, only recognizes seven official engineers.

The subordinate engineers are employed by the Division Engineers, with the assent of the State Engineer and Surveyor and the Canal Commissioner in charge of the division on which they are so employed.

The offices of the Division and Resident Engineers are located as follows:

At Albany, for the Eastern Division.
At Syracuse for the Middle Division.
At Rochester, for the Western Division.
At Owego, for the Chenango canal extension.

The expenditures, on account of the engineer department for the year ending September 30, 1870, are as follows:

Eastern Division		*$54,164 34
Middle Division	$31,855 29	
Chenango canal extension	23,566 98	
		55,422 27
Western Division		32,159 55
Total		$141,746 16

The following shows the amount of work done under the supervision of the engineer department during the fiscal year:

Eastern Division		$781,116 99
Middle Division	$709,797 80	
Chenango canal extension	303,759 18	
		1,013,556 98
Western Division		471,384 72
Total		$2,266,058 69

The cost of engineering has been about six and two-tenths per cent of the cost of the work done.

CANALS.

The State canals, for convenience in construction and the superintendence of repairs, are divided into three divisions, Eastern, Middle and Western; each under the charge and supervision of a Canal Commissioner, a Division and Resident Engineer.

EASTERN DIVISION.

Names of canals.	Miles.
Erie canal from Albany to east bank of Oneida Lake canal.	133.58
Albany basin (called one mile for tolls by chapter 200, Laws of 1849)	.77
Port Schuyler and West Troy side cut	.35
Pond above Troy dam	3.00
Champlain canal and Waterford side cut	66.00
Glen's Falls feeder and pond above	12.00
Black River canal	35.33
Black River feeder and pond above dam	12.09
Delta feeder	1.38
Black River improvement	42.50
Total miles	307.00

This division has been in charge of E. H. Crocker, Division Engineer, and Peter Hogan, Resident Engineer.

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* This amount includes $9,449.02 for survey for the Champlain canal enlargement.

Middle Division.

Names of canals.		Miles.
Erie canal from east side of Oneida Lake canal to east line of Wayne county		68.58
Navigable feeders to Erie canal:		
Limestone	.80	
Butternut	1.55	
Camillus	1.00	
		3.35
Oneida Lake canal		7.00
Oswego canal		38.00
Cayuga and Seneca canal		22.77
Crooked Lake canal		8.00
Chemung canal and feeder		39.00
Chenango canal		97.00
Oneida River improvement		20.00
Seneca River towing-path		5.75
Baldwinsville canal and improvement to Jack's Reef		12.50
Cayuga inlet		2.00
Total miles		323.95

This division has been in charge of M. S. Kimball, Division Engineer, and Howard Soule, Jr., Resident Engineer. The Chenango canal extension has been in charge of Charles L. McAlpine, Resident Engineer.

Western Division.

Names of canals.	Miles.
Erie canal from East line of Wayne county to Buffalo	148.50
Genesee Valley canal from Rochester to Millgrove	113.50
Dansville branch of Genesee Valley canal	11.00
Genesee feeder at Rochester	2.25
Genesee feeder at Oramel	.75
Total miles	276.00

This division has been in charge of Daniel Richmond, Division Engineer, and J. Nelson Tubbs, Resident Engineer.

From the above statements, it will be seen that there are 906.95 miles of navigable canals and feeders, and there are also 5.68 miles of unnavigable feeders, making a total of 912.63 miles of canals and feeders under the supervision of this department, exclusive of the Chenango canal extension, in process of construction.

The total length of navigable canals and feeders, with rivers and lakes connected artificially therewith, in the State of New York:

	Miles.
Total length of artificial canals and feeders	906.95
Length Hudson river, New York to Waterford	155.00
Lake Champlain, Whitehall, to Rouse's Point	111.00
Oneida lake	22.00
Cayuga lake	39.00
Seneca lake	35.00
Crooked lake	19.00
Delaware and Hudson canal (in this State)	87.00
Junction canal	18.00
Total	1,392.95

Dimensions and Capacity of the New York State Canals.

NAME OF CANAL.	When authorized.	When completed.	Length in miles.	SIZE OF CANAL.			NUMBER AND SIZE OF LOCKS.			Average burden boats.	Maxim'm burden of boats.
				Width on surface.	Width on bottom.	Depth of water.	Number of locks.	Length between quoins.	Width in clear.		
Erie canal (original)	1817	1825	363	40	28	4	83	90	15	70	76
Erie canal, enlargement same	1835	1862	350½	70	56	7	72	110	18	210	240
Oswego canal (original)	1825	1828	38	40	24	4	18	90	15	70	76
Oswego canal, enlargement same	1847	1862	38	70	56	7	18	110	18	210	240
Cayuga and Seneca canal (original)	1825	1828	21	40	24	4	10	90	15	70	76
Cayuga and Seneca canal, enlargement same	1836	1862	23	70	56	7	11	110	18	210	240
Champlain canal	1817	1822	66	50	35	5	20	100	18	80	85
Champlain canal (Glen's Falls feeder)	1822	1837	12	50	35	5	12	100	18	80	85
Champlain canal (pond above Troy dam)	1822	1837	3	....	....	....	1	....	....	....	....
Black River canal and feeder	1836	1849	50	42	26	4	109	90	15	70	76
Black River canal improvement	1849	1861	42	....	....	....	1	110	18	70	76
Genesee Valley canal	1826	1861	124¾	42	26	4	112	90	15	70	76
Chenango canal	1833	1836	97	40	24	4	116	90	15	71	76
Chemung canal and feeder	1829	1831	39	42	26	4½	53	90	15	85	90
Oneida River improvement	1839	1850	20	80	60	4½	2	120	30	70	76
Oneida Lake canal	1832	1836	7	40	24	4	7	90	15	70	76
Baldwinsville canal and Seneca towing-path	1838	1839	5¾	40	24	4	1	90	15	70	76
Crooked Lake canal	1829	1833	8	42	26	4	27	90	15	70	76

Feeders.

The following embraces all the available feeders for supplying the Erie canal with water during the dry season, with approximate cost of each:

NAME OF FEEDER.	When brought into use.	Source of supply.	Miles entering the canal from Albany.	Supply cubic feet per minute.	Total cost of feeder.
Mohawk river at Cohoes	....	Champlain canal	....	6,570	....
Rexford Flats feeder	1844	Mohawk river	26	10,979	$25,000 00
Schoharie Creek feeder	1845	Creek	51	6,800	30,000 00
Rocky Rift feeder	1856	Mohawk river	78	10,602	190,000 00
Little Falls feeder	1843	Mohawk river	87	12,643	12,500 00
Ilion Creek feeder	1838	Creek	98	800	1,000 00
Chenango canal	1836	Through lock	110	911	....
Butts' creek	1838	Creek	124	1,400	530 00
Mohawk feeder at Rome	1858	Mohawk river	125	11,766	25,976 36
Black River canal at Rome	....	Through lock	125	1,294	....
Oneida Creek feeder	1835	Creek	140	1,500	34,498 00
Cowasselon Creek feeder	1858	Creek	143	320	10,089 65
Erieville reservoir	1850	Reservoir	......	2,130	36,837 03
Chittenango Creek feeder	1840	Creek and outlet	152	250	7,555 33
Cazenovia Lake reservoir	1857	Reservoir	......	2,631	10,884 73
De Ruyter reservoir, through	18[illegible]	Reservoir	158	3,972	158,378 20
Limestone creek	1852	Creek and outlet		210	14,871 30
Orville (Butternut creek) feeder	1858	Creek	161	450	45,000 00
Camillus feeder	1843	Creek	175	1,500	11,327 68
Skaneateles Lake reservoir	1844	Reservoir	185	7,520	14,927 55
Genesee River feeder	1826	Genesee river	259	350	42,750 54
Genesee Valley canal	1842	Through lock	259	861	....
Oak Orchard Creek feeder	1840	Creek	303	1,400	29,722 42
Lake Erie, Buffalo	1856	Lake	350½	35,000	....
				121,867	....
Total cost enlargement feeders				....	$701,848 79
Total cost original Erie canal feeders				....	101,147 00

Locks.

NAME OF CANAL.	Length in miles of canals.	Number of locks.	Feet of lockage.	Feet lockage per mile.
Erie canal (57 double, 15 single)	351.78	72	654.80	1.86
Navigable feeders of same	3.35	....	....	....
Champlain canal	66.00	33	179.50	2.72
Pond above Troy dam	3.00	....	....	....
Glen's Falls feeder and pond	12.00	....	132.00	11.00
Black River canal	35.33	109	1,082.25	30.63
Black River feeders	13.47		....	....
Black River improvement	42.50	1	....	....
Oneida Lake canal	6.00	7	62.00	10.33
Oswego canal	38.00	18	154.85	4.07
Oneida River improvement	20.00	2	7.85	0.39
Seneca River towing-path	5.00	....	....	....
Baldwinsville canal	1.00	1	8.00	8.00
Cayuga and Seneca canal	22.77	11	76.61	3.36
Crooked Lake canal	8.00	27	277.83	34.73
Chemung canal and feeder	39.00	53	504.88	12.95
Cayuga inlet	2.00	1	....	....
Chenango canal	97.00	116	1,015.33	10.46
Genesee Valley canal and feeder	116.50	114	1,045.39	8.96
Dansville branch	11.00		82.50	7.50
	893.70	565	5,283.79	5.09

Bridges.

The total number of bridges upon all of the State canals is one thousand three hundred and eighteen, as follows:

Upon the enlarged canals, viz.: The Erie, Oswego, Cayuga and Seneca, bridges of not less than seventy-two feet clear span:

Street and road bridges of iron	161	
Street and road bridges of wood	236	
Farm bridges of iron	6	
Farm bridges of wood	192	
Tow-path and change bridges of iron	1	
Tow-path and change bridges of wood	31	
		627

Bridges of not less than fifty feet span, located upon the Champlain, Chenango, Black river, Oneida Lake, Chemung, Crooked Lake, and Genesee Valley canals:

Street and road bridges of iron	19	
Street and road bridges of wood	328	
Farm bridges of wood	320	
Tow-path and change bridges of wood	24	
		691
		1,318

NUMBER, extent and approximate cost of structures upon the Erie canal at completion of enlargement in 1862.

Quantities.	KIND OF STRUCTURES.	Price.	Amount.
437,869..	Square feet flooring in 158 iron bridges	81	$354,673 89
516,259..	Square feet flooring in 382 wooden bridges	38	196,178 42
540 sets..	Bridge abutments	$2,750 00	1,485,000 00
540 sets..	Bridge embankments, etc	1,800 00	972,000 00
57 sets..	Double locks, aggregate length 9,838 feet	73,850 00	4,209,450 00
13 single..	Locks, aggregate length 2,415 feet	31,560 00	441,840 00
2 single..	Guard locks, aggregate length 345 feet	23,000 00	46,000 00
5 single..	Weigh locks, aggregate length 737 feet	47,036 00	235,180 00
24,235..	Lineal feet of trunk in 32 aqueducts	310 00	7,512,850 00
2,363..	Lineal feet of waste walls, waste-weirs	42 00	99,246 00
11..	Stop gates	2,000 00	22,000 00
190..	Stone arch culverts, aggregate spans 1,523	4,000 00	760,000 00
94..	Composite culverts, aggregate spans 435	1,700 00	159,800 00
	Total approximate cost of structures	....	$16,494,218 31

STATEMENT showing the total cost of construction of the New York State canals, together with the cost of repairs, maintenance and collection; also the total amount of tolls received from each. (Each canal is credited with the amount of tolls upon the tonnage contributed to the Erie, and charged with its proportion of repairs and maintenance upon the same, up to and including 1866.)

NAME OF CANAL,	EXPENDITURES.			RECEIPTS.
	For construction, enlargements and improvem'ts.	For repairs maintenance and collection.	Total for construction, management, etc.	From tolls.
Erie and Champlain	$46,018,234	$12,900,333	$58,918,567	$81,057,168
Oswego	3,490,949	4,639,219	8,130,168	9,283,230
Cayuga and Seneca	1,520,542	1,200,044	2,720,586	2,184,300
Chemung	1,273,261	1,794,649	3,067,910	2,012,575
Crooked Lake	333,287	459,374	792,661	520,416
Chenango	2,782,124	1,022,026	3,804,150	737,285
Black River	3,224,779	498,866	3,723,645	242,603
Genesee Valley	5,827,813	1,689,303	7,517,116	1,306,913
Oneida Lake	64,837	123,234	188,071	65,180
Baldwinsville	23,556	25,035	48,591	1,261
Oneida River improvement	146,944	25,005	171,999	204,288
Seneca River towing-path	1,488	20	1,508	5,251
Cayuga inlet	2,968	....	2,968	4,596
Totals	$64,710,832	$24,377,108	$89,087,940	$97,625,066

Total cost of construction, as above	$64,710,832
Total interest on same	93,736,654
Total cost maintenance, repairs and collection	24,377,114
Total interest on same	27,268,895
Total from commencement to completion	$210,093,495
Aggregate receipts from tolls, with interest thereon	202,619,510
Present cost to the State of the entire canal system	$7,473,985

The number and tonnage capacity of the boats built and registered in each year since 1857 has been as follows:

YEAR.	Boats.	Tons.	Average of boats.
1857	329	37,510	114
1858	255	27,830	109
1859	206	20,150	98
1860	403	48,355	120
1861	619	95,230	154
1862	850	142,470	168
1863	771	119,170	177
1864	399	56,235	141
1865	200	28,795	144
1866	485	74,630	154
1867	520	80,360	155
1868	387	64,470	167
1869	298	46,640	157
	5,722	841,845	

COMPARATIVE statement of the total tonnage movement over the New York State canals, New York Central Railroad and Erie Railway, together with the receipts per ton per mile on each from 1860 *to* 1869 *inclusive.*

YEAR.	NEW YORK STATE CANALS.		NEW YORK CENTRAL RAILROAD.		ERIE RAILWAY.	
	Tons moved one mile.	Receipts per ton per mile.	Tons moved one mile.	Receipts per ton per mile.	Tons moved one mile.	Receipts per ton per mile.
		Cts.		Cts.		Cts.
1860	809,524,596	0.994	199,231,392	2.06	214,084,395	1.84
1861	863,623,507	1.080	237,392,974	1.96	251,350,127	1.73
1862	1,123,548,430	0.959	296,963,492	2.22	351,092,285	1.89
1863	1,034,130,023	0.876	312,195,796	2.40	403,670,861	2.09
1864	871,335,150	1.150	314,081,410	2.75	422,013,644	2.31
1865	843,915,779	1.100	264,993,626	3.31	888,557,213	2.76
1866	1,012,448,034	1.000	331,075,547	2.92	478,485,772	2.45
1867	958,362,953	0.900	362,180,606	2.53	549,888,422	2.04
1868	1,033,751,268	0.880	366,199,786	2.59	595,699,225	1.92
1869	919,153,611	0.920	474,419,726	2.20	817,829,190	1.60
	9,469,793,423	....	8,158,734,855	....	4,619,798,173	....

It appears from the foregoing, that since 1860 the canals have moved about twenty-four per cent more freight than the New York Central and Erie railroads together; and that the average yearly business on the canals for the nine years following 1860 was nineteen per cent greater than the business for that year, and that the average yearly business on the railroads for the same period was eighty-nine per cent greater than the business for the year 1860. Thus, notwithstanding the active competition with which the canals have had to contend—the railroads continually extending their lines and connections—the average business for the ten years shows a fair increase over preceding years.

As between the two railroad lines, the above table is not a fair comparison, as the Erie operated 264 more miles of road in 1869 than in 1860, while the New York Central operated only thirty-seven miles more.

The following shows the cost of construction and equipment of the three lines:

	Cost.	Miles.
New York State canals	$80,710,832	900
New York Central railroad	37,603,697	593
Erie railway	65,131,959	823
	$183,446,488	2,316

The total number of tons moved one mile on all the canals and railroads in the State, in the ten years from 1860 to 1869, inclusive, was 19,662,593,782; of this amount, the canals, with an average season of less than seven and one-half months in each year, transported $48\frac{2}{10}$ per cent, or very nearly one-half; and all the railroads, in operation the whole time, transported $51\frac{8}{10}$ per cent. In several of these years the canals transported more freight in the seven and one-half months than all the railroads in the State did in the whole twelve months.

In 1860 there were 3,146 miles of railroads in operation in this State; and in 1869, 4,430 miles; an increase of 1,284 miles.

WORK UNDER CONTRACT.

SATEMENT showing the total amount of work done during the fiscal year ending September 30th, 1870; *also the amount of work remaining to be done on all existing contracts upon the New York State canals, under supervision of the Engineer Department.*

NAME OF CANAL.	Amount done during the fiscal year.	Amount remaining to be done.
Erie	$805,195 22	$834,049 22
Champlain	218,204 29	203,785 00
Black River	53,956 00	23,471 23
Oswego	70,589 69	154,747 75
Chenango	83,146 46	33,722 25
Chemung	70,846 60	28,222 90
Cayuga and Seneca	56,865 75	18,601 00
Baldwinsville	3,912 70	....
Genesee Valley	186,835 66	65,320 00
Total for ordinary and extraordinary repairs	$1,549,553 27	$1,361,919 35
Special Improvements and Extension.		
Champlain canal improvement, chap. 186, Laws of 1864	$156,566 24	$23,183 00
Oneida Lake canal enlargement	199,440 00	85,240 00
Chenango canal extension	303,759 18	593,971 39
Doubling locks on the Western Division	56,740 00	404,260 00
Total for improvements, etc	$716,505 42	$1,106,654 39
Grand total	$2,266,058 69	$2,468,573 74

WORK AUTHORIZED NOT UNDER CONTRACT.

The following is the estimated cost at engineer's prices of authorized work not under contract:

On the extension of the Chenango canal	$243,773 00
Construction of Fish Creek feeder	693,250 00
Total	$937,023 00

THE CONDITION OF THE CANALS.

By referring to the reports of the division engineers, it will be seen they all call attention to the marked improvement in the general condition of the canals, and to the freedom from breaks and other interruptions to navigation during the past season. This testimony is not confined alone to the employes of the State, but is universally concurred in by all the forwarders, boatmen and others whose interests or occupations have brought them in contact with the canals, and is, in my opinion, but a just commendation of the system of restoration inaugurated by the laws of 1870. The expense connected with these improvements has been in excess of that required for operating the canals in previous years, but it is generally conceded it was necessary in view of the dilapidated condition into which the works had fallen, due to the evil effects of keeping the canals in repair by contract.

That this system of restoration should be gradually continued, and that such improvements as will facilitate the transit of freight, should, from time to time, be added, until the canals are brought up to their full capacity, is, I believe, the true and most advantageous policy to be pursued.

For details of the work done in the past season and for recommendations for the requirements of the coming season, for which appropriations are needed, reference should be had to the reports of the division engineers.

ENLARGEMENT OF THE ONEIDA LAKE CANAL.

The length of this canal upon the enlargement line is $5\frac{3}{10}$ miles, and embraces six locks. The dimensions of the locks and prism are the same as those of the enlarged Erie canal; for convenience in letting the work, it was divided into five sections of about one mile in length each.

The work was authorized to be placed under contract by act, chap. 934, Laws of 1867, provided the aggregate of the lowest bids should not exceed $346,153.47, which amount was appropriated by the same act.

The work was let for a gross sum for each section, to include the locks and all other structures located thereon, and was put under contract by sections, December 18, 1867, to be completed by July 1, 1869. The aggregate cost of the work under these contracts amounted to $258,000, or $88,153 less than the appropriation. The engineer's estimates of the cost of the same previous to the letting was $306,000.

In the progress of the construction a harder class of material was met with in the excavation than was anticipated when the work was let. A relief for the same was sought for and obtained by the passage of chapter 913, Laws of 1869, which authorized the Canal Board to settle with and pay the contractors by supplementary contracts or otherwise for the removal of this material, but in no case was the expenditure to exceed the amount of the original appropriation. The revised estimates under this act amounted, in the aggregate, to $314,000, which were approved by the Canal Board, and supplemental contracts made in accordance therewith. This increased the cost of the work, above the original contracts, $56,000, leaving $32,153 of the sum appropriated, and which was deemed by the Canal Board not only a fair adjustment of the matter, and leaving no more than a proper allowance for engineering and contingencies, but a full compliance with all previous acts of the Legislature. A further allowance was, however, made by the Board of Canal Commissioners, under act, chap. 737, Laws of 1870, upon the locks embraced in the contracts, to be paid out of any money appropriated for this canal, which brings the cost of the work up to $416,000, or $69,847 in excess of the appropriation to which the cost was restricted by act, chap. 934, Laws of 1867.

By reference to the Division Engineer's report, it will be seen that under the prices established by the foregoing relief bills, the total amount of work done is $330,760, and the amount remaining to be done, including engineering and contingencies, $100,000.

This canal will be supplied with water from the Erie canal, drawn from the long level, at Durhamville, fifteen miles west of Rome, and about ten miles west of the proposed entrance of the new supply from Fish Creek.

Fish Creek Feeder.

The construction of Fish Creek feeder was authorized by act, chapter 877, Laws of 1869, which also appropriated $100,000 toward its construction.

The superior advantages possessed by this, over other sources, either natural or artificial, for supplying the deficiency of water on and east of the long level on the Erie canal, and the additional supply that will be required for the Oneida Lake canal when completed, have been fully demonstrated and conceded by all who have had the matter under serious consideration. It was observed in my last report that "Taking into consideration the permanency of this stream, its volume and favorable location for a reliable and immediate relief to not only the long level, but to all the levels between it and Little Falls, upon which navigation is greatly impaired for want of a sufficient supply of water, I am of the opinion that this improvement is of the first importance, and should be at once placed under contract."

To a careful and judicious management of the present supplies, and to the opportune rains in the latter part of the season, is it alone due that serious interruptions to navigation have not occurred on the long level during the past season; and had the Oneida Lake canal been in operation, drawing, as it will, 2,500 cubic feet per minute from this level, these interruptions would have been unavoidable.

Objections have been raised by the citizens of Oswego to this diversion of the waters of Fish creek, as it is claimed that thereby the manufacturing interests of their city would be seriously interfered with. It has been shown in former official reports that the State, by the construction of the Erieville, De Ruyter, Cazenovia Lake and Skaneateles Lake reservoirs, together with the waters drawn from Lake Erie and the Chemung river, has largely increased the flow of the Oswego river, during the dry part of the year, over that of its natural drainage. Assuming that no addition to its flow has been contributed by the State, then that part of the waters of Fish creek diverted for the use of the long level and not returned to this river through the Oneida Lake canal, and at the Lodi lock, is so small that it could be easily and fully made up by the construction of compensating reservoirs at the head waters of Fish creek, which it has been ascertained by recent examinations could be constructed at a small expense.

The estimated cost of constructing this feeder, whereby a supply of 8,000 cubic feet of water per minute will be secured, is $693,250.

EXTENSION OF THE CHENANGO CANAL.

By referring to the report of the Resident Engineer in charge of this work, it will be seen the total amount that has been expended on the same is $1,377,574.69, and that the cost to complete will be as follows:

Work under contract remaining to be done	$593,971 39
Work not under contract	243,773 00
Total cost to complete	$837,744 39

Improving the Lockage Facilities.

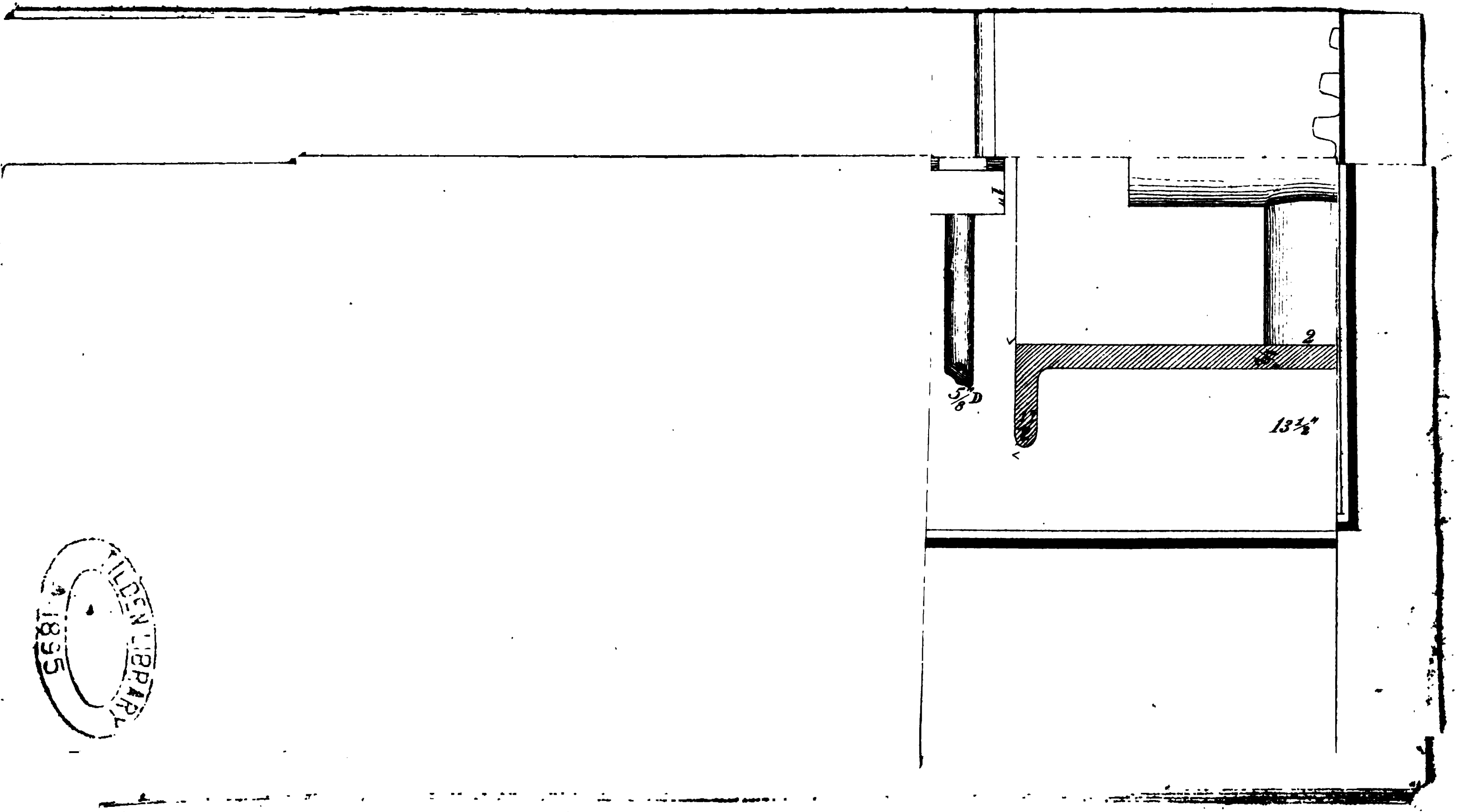
The capacity of a canal (all things being equal) is determined by the number of lockages that can be made in a definite time; it is therefore important that the locks should receive such attention as will insure to the canals their full capacity.

An improvement known as the tumble gate has been introduced upon several locks within the past two or three years, and has been found to work so well and to be so much superior to the present form of gate that I am of the opinion they should be substituted, whenever the gates now in use at the head of the lock require renewing. This should be done on the Erie canal at least.

Another improvement has been presented, with which it is proposed to utilize the power now lost in the passage of the feed water between the locks, by applying it to machinery for opening and closing the gates without the aid of manual labor, and for aiding the boat to enter and leave the lock, thereby shortening the time of the lockage. Permission has been granted the inventor by the Canal Board, to make a trial at lock number thirty-seven on the Erie canal. Should the experiment prove what is claimed for it, the invention would be of great importance.

Navigating the Canals by Steam.

I still retain the opinion, expressed in my last annual report, that the direct solution of the question of the practicability and economy of navigating the canals with steam power, can be more speedily and satisfactorily arrived at by immediately placing the matter in the hands of the Canal Board. It was then stated: "The question of the practicability of navigating the canals with steam as a motive power should be settled at the earliest practicable moment, and I would recommend that an appropriation be made of not less than $20,000, and authority given to the Canal Board to have such experiments and examinations made as would determine the best methods of applying steam to canal navigation, and that said board be



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empowered to employ a competent engineer to assist in such investigation."

Heretofore the experiments have been left entirely at the risk and expense of the inventors, most of whom, it seems, have not been fully acquainted with the principles involved in the navigation of contracted or artificial channels, which differ widely from the laws governing the navigation of open or unlimited water-ways, and which may account for the failure of these experiments in many instances.

Upon this point, it was said in the report for 1868:

"Attempts have hitherto been made to substitute steam for horse-power upon the canal. These have all thus far failed, probably from the fact, that the machinery used was not properly proportioned to the work which it was designed to perform, and that too high a rate of speed was sought to be obtained. The law connecting the resistances offered to bodies moving in water with the power required to overcome such resistances, may be stated as follows:

"The resistance varies as the square of the speed, and the power exerted varies as the cube of the speed; hence, if two horses were sufficient to tow a boat at a speed of two miles an hour, the number required to tow the same at a speed of four miles per hour would be ($2 — \frac{4}{2}\frac{3}{3} = \frac{2x64}{8}$) 16 horses. It appears, therefore, in order to double the speed, the propelling power must be increased eight times. The obvious effect of the double speed would be to reduce the time of transit one-half; this, however, would be secured only at an expenditure for propulsion eight times as great as that due to a speed of two miles per hour.

"The foregoing determinations and comparisons are based upon the assumption that two horses will tow a loaded boat at a speed of two miles per hour upon the canal; as shown by M. D'Aubuisson's formula, forty-four per cent more power is required to maintain the same speed upon the canals than in an indefinite fluid. For example, as shown in a former calculation from D'Aubuisson's formula, the traction or resistance encountered upon the Erie canal with the large class of boats, carrying 210 tons, at a speed of two miles an hour, is 428 lbs.,* requiring about three horses; then the resistance, at a speed of four miles an hour, would be $(\frac{43 \times 428}{23})=3,424$ lbs., requiring over twenty-three horses.

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* The formula for ascertaining the force required upon the canal is $2.6689\frac{S2 \times V2}{C + 2S}$=lbs., in which S is the sectional area of the boat; C the sectional area of the canal; and V the velocity in feet per second. It has been determined, from experiment, that the navigation upon canals becomes the same as upon an indefinite open water way, where the sectional area of the canal is six and one-half times that of the immersed section of the boat, and its width four and one-half times that of the boat; substituting this in the above formula and the resistance becomes 301 lbs.

If steam power should be provided sufficient to obtain an average speed a little in excesss of that realized from present horse-power, then it might undoubtedly be successfully and economically employed upon our canals.

I would recommend that authority be given the Canal Board to employ a competent engineer to prepare designs and plans for the construction, on the most approved plan, of one boat, with machinery complete, to be placed on the canals for trial at the earliest practicable moment, and that a sufficient appropriation be made for defraying the expenses of the same.

In conclusion, I would respectfully call the attention of the Legislature to the reports of the Division Engineers, herewith submitted, in which will be found a full description of the condition of all the canals, reservoirs and feeders. They give in detail the extent and character of work done and to be done on repairs under the supervision of this department, and the cost of said work.

Respectfully submitted.

VAN R. RICHMOND,
State Engineer and Surveyor.

EASTERN DIVISION.

ANNUAL REPORT OF E. H. CROCKER, DIVISION ENGINEER, FOR 1870.

Division Engineer's Office,
Albany, *October* 1*st*, 1870.

Hon. Van R. Richmond, *State Engineer and Surveyor:*

Sir.—In accordance with the regulations established under act chapter 169, Laws of 1862, I have the honor to present you my annual report.

The navigable canals, river improvements and feeders remain the same as last year, and are as follows:

	Miles.
Erie canal, from Albany to east bank of Oneida Lake canal..	133.58
Albany basin (called 1 mile, for tolls, chap. 200, Laws of 1849)	.77
Port Schuyler and West Troy side cuts	.35
Pond above Troy dam..................................	3.00
Champlain canal and Waterford side cut	66.00
Glen's Falls feeder and pond above,.....................	12.00
Black River canal....................................	35.33
Black River feeder and pond above dam	12.09
Delta feeder...	1.38
Black River improvement.............................	42.50
Total Eastern Division	307.00

FEEDERS NOT NAVIGABLE.

Mohawk river at Rexford Flats	0.39
Schoharie creek......................................	0.63
Mohawk at Rocky Rift	3.92
Mohawk, south side, at Little Falls......................	0.19
Mohawk, north side, at Little Falls, partly navigable.......	0.50
Mohawk at Rome.....................................	0.05
Total length	5.68

Reservoirs.

NAME.	Area of surface acres.	Average area acres.	Depth feet.	Capacity cubic feet.
Woodhull	1,826	1,118	18	876,550,000
North Branch (can be filled twice yearly)	423	277	28	310,000,000
South Branch	518	372	26	421,190,000
Total	2,177	1,767	......	1,607,740,000

Supply of water for Erie canal.

SOURCE.		Distance to be supplied in miles.	Quantity furnished in cubic feet per minute.
Champlain canal, from Mohawk river at Cohoes		7	6,570
Mohawk river at Rexford Flats		20	10,979
Schoharie creek		25	6,800
Mohawk river at Rocky Rift		27	10,602
Mohawk river at Little Falls		9	12,643
Ilion creek	800	48	16,296
Chenango canal	911		
Butts creek, two and a half miles east of Rome	1,400		
Mohawk and Black rivers at Rome	11,766		
Black River canal	1,294		
Wood creek at Rome	125		
		136	63,890

SUPPLY OF WATER FOR CHAMPLAIN CANAL.

From the junction with the Erie canal at West Troy to a point one mile north of Waterford, a distance of five miles, the supply is from the Mohawk river at Cohoes; from one mile north of Waterford to the crossing of the Hudson river, two and a quarter miles south of Fort Miller, a distance of twenty-five miles, the supply is from the Hudson river at Saratoga dam; from that point to Whitehall, a distance of thirty-five miles, the supply is from Glen's Falls feeder and Wood creek.

SUPPLY OF WATER FOR BLACK RIVER CANAL.

From the junction with the Erie canal at Rome to lock No. 9, seven miles, the supply is from the Delta feeder, taken from Mohawk river; from lock No. 9 to lock No. 34, ten miles, the supply is from Lansing Kill feeder; from lock No. 34 to lock No. 102, seventeen miles, the supply is from the Black River feeder; from lock No. 102 to lock No. 109, one and a third miles, the supply is from the pond above dam at Lyon's Falls.

The water furnished by the reservoirs is drawn only in the very dry season, and passed down through the natural channel of Black river and Woodhull, about twenty miles each to the pond above dam, at head of Black River feeder, thence the necessary quantity is taken into said feeder, and passed to the summit level at Booneville. From this point the canal is supplied both ways, and the balance, designed for the use of the Erie canal is passed off by a waste-weir into the Lansing Kill at the south end of the summit, thence into the Mohawk river, from whence it enters the Erie canal by the feeder at Rome.

ENGINEERING DEPARTMENT.

On the last day of the fiscal year the number of persons employed in this department exclusive of the Division and Resident Engineers, and exclusive also of those employed on the survey for the enlargement of the Champlain canal, under chapter 788, Laws of 1870, were seventeen (17), of these eleven were employed on the Erie canal, two on the Erie and Champlain, three on the Champlain and one on the Black River canal. On the survey for the enlargement of the Champlain thirty-two (32) were employed, there being two parties in order to expedite and complete the field work this fall.

The annexed table, No. 1, exhibits the name, rank, period of service and compensation of all persons so employed, and the amount expended for engineering during the fiscal year.

Act chapter 169, Laws of 1862, places the repairs of the canals under the general supervision of the engineers appointed by the Canal Board, and the expenditures for engineering under this head are as follows:

Repairs, Erie canal	$3,294 78
Repairs, Champlain canal	1,933 82
Repairs, Black River canal	784 92
Total	$6,013 52

The expenditures for engineering on the improvement of the Champlain canal under act chapter 186, Laws of 1864, during the fiscal year are $8,943.99.

The expenditures on the surveys for the construction of Fish Creek feeder and the enlargement of the Champlain canal under acts chapter 877, Laws of 1869, and 788, Laws of 1870, are as follows:

Survey Fish Creek feeder	$2,682 71
Survey, enlargement Champlain canal	9,449 02
Total	$12,131 73

The work on ordinary and extraordinary repairs ordered by the Canal Board, and authorized by general and special laws has been under the supervision of the engineer department, and the expenditures for engineering were paid by the Canal Commissioner in charge, as were also those incurred in the water surveys on Black river for the benefit of the State in the case of the Black river claims, and are as follows:

Repairs, Erie canal	$20,589 10
Repairs, Champlain canal	5,070 00
Repairs, Black River canal	784 00
Water surveys, Black river	632 00
Total	$27,075 10

The expenditures for engineering on this division, including those on the surveys for the fiscal year, are as follows:

Ordinary repairs	$6,013 52
Improvement Champlain canal	8,943 99
Survey, Fish Creek feeder	2,682 71
Survey, enlargement Champlain canal	9,449 02
Extraordinary repairs and water survey	27,075 10
Total	$54,164 34

The following comparative tables, A and B, shows the amount of work done during the fiscal years ending September 30th, 1869 and 1870, the cost of engineering and superintending, and the percentage. Table B shows the cost of engineering and the percentage, excluding the expenditures on surveys of Fish Creek feeder, enlargement Champlain, and water survey on Black river. The latter table gives the true exhibit, inasmuch as there has been no expenditures for work done on those surveys.

A.

NAME OF CANAL.	1869.			1870.		
	Work done.	Engineering.	Percentage.	Work done.	Engineering.	Percentage.
Erie	$183,177 20	$21,081 82	11.50	$352,390 46	$26,566 59	7.53
Champlain	236,873 91	15,434 64	6.51	374,770 53	25,396 83	6.77
Black River	14,193 82	4,522 60	31.80	53,956 00	2,200 92	4.00
Total	$434,244 93	$41,039 06	9.4-10	$781,116 99	$54,164 34	6.9-10

B.

NAME OF CANAL.	1869.			1870.		
	Work done.	Engineering.	Percentage.	Work done.	Engineering.	Percentage.
Erie	$183,177 20	$15,361 57	8.38	$352,390 46	$23,883 88	6.70
Champlain	236,873 91	15,434 64	6.51	374,770 53	15,947 81	4.25
Black River	14,193 82	4,180 60	29.00	53,956 00	1,568 92	3.00
Total	$434,244 93	$34,926 81	8.	$781,116 99	$41,400 61	5.3-10

WORK ON THE DIFFERENT CANALS.

The amount of work done during the fiscal year on all the canals under the immediate supervision of this department is as follows:

Erie Canal.

Ordinary repairs, under contract	$93,819 50	
Extraordinary repairs, under contract	230,704 54	
Extraordinary repairs, not under contract,	27,866 42	
		$352,390 46

Champlain Canal.

Ordinary repairs, under contract	$81,149 99	
Extraordinary repairs, under contract	123,106 88	
Extraordinary repairs, not under contract,	13,947 42	
Improvement Champlain canal	156,566 24	
		374,770 53

Black River Canal.

Ordinary repairs, not under contract	$36,936 00	
Extraordinary repairs, under contract	14,520 00	
Extraordinary repairs, not under contract,	2,500 00	
		53,956 00
Total work done		$781,116 99

Description of work done during the year:

ERIE CANAL.

Ordinary Repairs.

The annexed table number three is an exhibit of the expenditures under this head, and aside from dredging the Albany basin, nothing of consequence has been done under the supervision of this department.

EXTRAORDINARY REPAIRS.

The following work authorized by Laws of 1868 has been completed: Removing wall bench and constructing 900 lineal feet of wood docking, at Rome; removing iron bridge from Washington to George street, Rome, and constructing iron bridge at Washington street; raising and repairing Troy dam; removing wall bench, etc., on the tow-path side from lock No. 20, to a point one mile above upper Mohawk aqueduct; also, removing wall bench, etc., on the tow-path side from lock No. 2 to Port Schuyler.

The following work authorized by Laws of 1869 has been completed: Iron foot bridge at Utica; iron bridge at Spraker's Basin; iron road and tow-path bridge attached at Oneida street, Cohoes; and the wrought iron bridge over the Erie canal, at Railroad street, Ilion; four new tumble gates were inserted in locks No. 44 and No. 45 and brought into use at the opening of the canals in the spring, and add very much to the facilities of navigation at those points. Heretofore, delays at those locks have been frequent and annoying; but during the past season no complaints of that nature have been made. This gate works admirably, especially in high lifts and on short levels, and it is to be hoped that the time is not far distant when it will be entirely used in such cases. Locks No. 21 and No. 22 at the south end of the upper Mohawk aqueduct are each eleven and one half feet lift, and if consistent with the present state of the finances, it should be inserted in those locks immediately.

The annexed table No. 2, shows the progress of the work under contract authorized by Laws of 1868, 1869 and 1870.

CHAMPLAIN CANAL.

ORDINARY REPAIRS.

Table No. 3 shows work done and in progress, and what portion of the cost is chargeable to the revenues from the canals, the balance being provided for by tax.

EXTRAORDINARY REPAIRS.

The following work authorized by general and special laws has been completed: Bridge at McIntyre street, Fort Edward; farm bridge of G. F. Dudley; farm bridge of Lydia Ann Weaver; road bridge at Mechanicsville; Hewitt's lock; sluice at Saratoga guard lock; improvement at Schuylerville, and a wrought-iron road bridge over the Glen's Falls feeder at Green's crossing.

Should the season be favorable, the Cohoes dam will be completed next year. The contractor for the construction of that extensive work has been subjected to great hindrances and much loss on account of heavy freshets; but during the past season good progress has been made. Hewitt's lock was completed and brought into successful operation at the opening in the spring; the structure is a good one, and the contractor deserves credit for his management throughout the progress of the work. Another of Heath's "tumble gates" was inserted in this lock, and, like all the rest, works well. The guard lock at the head of the Glen's Falls feeder, built on the enlarged size, was so far advanced as to be used for navigation in the spring. It will be entirely completed this fall. The work on the stone dam at Fort Miller bridge has not made such progress as was desirable, but the contractor gives assurances that it shall be rapidly pushed forward to completion another season.

The following work, authorized by Laws of 1870, has been put under contract: The Troy dam, Flynn's lock, Glen's Falls feeder dam, vertical wall at Sandy Hill, improvement at Waterford, and wrought-iron road and tow-path bridge at Fort Edward.

It is expected that all this work will soon be in a fair state of progress and that some of it will be completed ready for navigation another year.

IMPROVEMENT OF THE CHAMPLAIN CANAL.

The annexed table, No. 2, shows the amount of work done under this head during the fiscal year. Some of these contracts are of long standing, and large amounts have been expended under them without accomplishing any very substantial results, inasmuch as there seems never to have been any fixed plans for the improvement, aside from widening and deepening the canal; others were closed up under the old administration some years ago. Those still remaining in force are shown in the table. Act, chapter 788, Laws of 1870, provides that all work done on the improvement after the passage of said act shall be done with reference to the enlargement, as prescribed therein, if the contractors will consent to such requirements; if not, they are permitted to surrender their contracts and be paid for all work done under them; or the Canal Board may, by resolution, annul the same and make a final settlement with the said contractors. There can be no question as to what course should be pursued in regard to these contracts, should the Canal Board adopt the maps, plans and estimates for the enlargement. The items and quantities to be submitted as a basis for letting any portion of that work, will be so different from those exhibited for the improvement as not only to render the existing contracts inapplicable, but also make it embarrassing for the officers in charge, as well as for the contractors in the performance of their duties.

BLACK RIVER CANAL.

Ordinary Repairs.

The chief item of expenditure made under the supervision of this department during the year was for the reconstruction of the North Branch reservoir. This work, which unfortunately went out in the spring of 1869, has been rebuilt and was brought into operation the past season.

Extraordinary Repairs.

The improvement of first level, Black River canal at Rome, has been completed; but the final account has not been settled, owing to a deficiency in the appropriation of sixteen hundred and eighty-one dollars and seventy-three cents ($1,681.73), which will be required to settle the amount due on said account. Table No. 2 shows the work let and in progress under the Laws of 1869 and 1870. The insertion of cast-iron discharge pipes at Woodhull reservoir, authorized by chapter 767 Laws of 1870, will add greatly to the security and efficiency of this valuable reservoir.

GENERAL IMPROVEMENTS.

Erie Canal.

In addition to the work under contract some thirty-six miles of the old wall bench on the tow-path side still remain in the canal on this division. Where it has been removed, taking into account the manner in which it had worked into the center of the canal, at least twenty per cent has been added to the efficiency of the prism. There is no improvement that could be made on this division that would so much benefit navigation. The bench still remaining on the tow-path side, and not under contract, is distributed as follows:

Between lock No. 23 and Fultonville	5.80 miles.
Between Sprakers and Little Falls	15.50 "
Between Little Falls and Utica	12.00 "
Between Newville and Wood Creek, through Rome	2.50 "
Total	35.80 miles.

A further appropriation should be made for their removal.

FISH CREEK FEEDER.

The deficiency in the supply of water for the Rome level, is a question that has, for the past eight or ten years, engaged the attention of, and been discussed by, all the engineers and Canal Commissioners in charge of this division of the canals. It has been admitted by all that a deficiency exists, and so great, too, especially during dry seasons, as to seriously embarrass navigation. Careful surveys and estimates have resulted in fixing that deficiency at a little less than 7,000 cubic feet per minute. While, there have existed a variety of opinions as to the source from which that supply should be obtained, all concede the importance of procuring it at the earliest possible moment. In 1861 a survey and estimate were made to determine what amount of water could be obtained from the east and west branches of Fish creek. "It was found that in the dry season both branches of this creek passed 13,512 cubic feet per minute." In 1869 another survey was made from a point about three miles west of Rome to the west branch of Fish creek, at McConnelsville, a distance of thirteen and three-tenth miles, and a careful estimate of the cost made, which amounted to $693,250; for the whole distance for that portion between the canal and the east branch, nine and one-tenth miles, $465,970. The plan is sixteen feet breadth of base, four feet depth, side slopes two to one, and surface width thirty-two feet, with a descent of six inches to the mile, capable of passing into the Erie canal 7,777 cubic feet per minute. With this feeder, we have every assurance, that a bountiful supply can be obtained from a living, unvarying and inexhaustible source. Other supplies may be secured at a less cost, but not so abundant, so reliable, and, in the end, so cheap. It would be wisdom, in my judgment, to place this work under contract immediately, that its benefits to navigation may be speedily realized.

Champlain Canal.

Two stop gates, one on the north and the other on the south side of the mouth of the Glen's Falls feeder, should be constructed on this canal before the opening next spring. The benefits that would arise would be very great, since, in case of a break on either side, navigation could be maintained on the other, and a great saving of time and water be effected.

The survey for the enlargement of this canal, under the provisions of chapter 788, Laws of 1870, has been in progress since the first day of July last. For the purpose of hastening it along as rapidly as possible, two parties were at that time set to work, one in charge of S. E. Babcock, on that portion of the canal extending from its junction at West Troy to Fort Miller bridge, and the other in charge of W. B. Cooper, on that portion extending from Fort Miller bridge to Whitehall. Both have been actively at work and made very satisfactory progress. It is expected that the field work will be completed the latter part of November, and the maps, plans and estimates ready for the consideration of the Canal Board about the first of January next. Business on this canal thus far the present year shows a large increase of tonnage with about the same amount of tolls as last year, and would have been much larger but for the low stage of water that has prevailed in the Hudson river throughout the entire season. The lumber manufactories have been forced to stand still, and a large number of operatives thrown out of employment for about half the season of navigation. The mills have been shut down and the water taken and used for canal purposes. The consequence has been an immense decrease in the manufacture of lumber and a consequent loss of that amount of business to the canals. This question has become an important one, not only to the operators and laboring population along the line of the stream, but also to the State in its loss of trade and tolls. It has been estimated from reliable data that the amount of lumber manufactured on the river within a distance of nine miles, between the village of Fort Edward and the Glen's Falls feeder dam, has been less this year by about ninety millions of feet B. M. than the average of the past five years. This trade has all been lost to the Champlain canal, and tolls to the amount of many thousands of dollars lost to the State. There is a remedy for this, and it should be resorted to at the earliest practicable period. It is in the construction of reservoirs on the head waters of the Hudson river, where nature in many instances offers marked facilities for such purposes. There are a number of lakes whose outlets could be dammed at a nominal expense, large areas flowed, and vast quantities of water husbanded for use in times of dry weather and need. It is estimated, from reliable information, that Indian lake alone, whose water-shed is about 125,000 acres, could, at a small expense, be converted into a reservoir that would hold about three thousand million cubic feet of water, nearly double the capacity of all three of the reservoirs on the head of the Black river. The same might be said of Schroon, Paradox and other lakes.

For a number of years past the Hudson river has been subject to heavy freshets, especially in the spring. The waters from rains and melting snow accumulating from those vast water-sheds more rapidly than in former years, passes into the main channel, swelling it to vast proportions, the mighty volume rushing onward, imperiling and damaging property to the amount of hundreds of thousands of dollars all the way from its source to the city of Albany. A few weeks elapse, and the water is so low as not only to stop the manufactories along the stream, but to embarrass navigation on the canal, and especially on the river in the vicinity of Troy and Albany. A few reservoirs constructed, as suggested, on the head waters of the river, would be of inestimable value in keeping back, in the spring or in times of excessive rains, this vast surplus of water for use whenever needed.

It is to be hoped that the attention of the Legislature will be called to this subject at an early day, and that appropriations will be made to pay the cost of examinations and surveys for these reservoirs.

Respectfully submitted.

E. H. CROCKER,
Division Engineer, Eastern Division.

TABLE No. 1.

SHOWING the number and compensation of Engineers employed on the Eastern Division of the New York State Canals, together with incidental expenses, from October 1st, 1869, *to September* 30*th*, 1870.

REPAIRS ERIE CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
E. Howard Crocker	Division engineer	......	$2,400	$1,260 00	
E. Howard Crocker	Travel	......	....	331 84	
Peter Hogan	Resident engineer	......	2,000	1,100 00	
Peter Hogan	Travel	......	....	385 02	
					$3,076 86
	Incidental expenses.				
	Postage	......	....	$84 12	
	Miscellaneous	......	....	133 80	
					217 92
	Total Erie canal	......	....	....	$3,294 78

REPAIRS CHAMPLAIN CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
E. Howard Crocker	Division engineer	......	$2,400	$760 00	
E. Howard Crocker	Travel	......	....	215 72	
Peter Hogan	Resident engineer	......	2,000	700 00	
Peter Hogan	Travel	......	....	258 10	
	Total Champlain canal	......	....	....	$1,933 82

REPAIRS BLACK RIVER CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
E. Howard Crocker	Division engineer	......	$2,400	$380 00	
E. Howard Crocker	Travel	......	....	106 44	
Peter Hogan	Resident engineer	......	2,000	200 00	
Peter Hogan	Travel	......	....	98 48	
	Total Black River canal	......	....	....	$784 92

IMPROVEMENT CHAMPLAIN CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
W. B. Cooper	Assistant engineer	103	$6 00	$618 00	
G. M. Barnes	Assistant engineer	66	5 00	330 00	
J. A. Watkins	Assistant engineer	142	5 00	710 00	
M. H. Roberts	Leveler	234	4 00	936 00	
Samuel Moak	Leveler	114	3 50	399 00	
J. W. Ingalls	Rodman	234	3 00	702 00	
Stephen Thorn	Rodman	78	3 00	234 00	
G. W. Satterlee	Rodman	234	2 50	585 00	
W. F. Potter	Rodman	194	2 50	485 00	
Thomas Grady	Axman	127	2 00	254 00	
O. H. Moore	Axman	23	3 00	69 00	
G. W. Satterlee	Axman	20	2 50	50 00	
David Evans	Office assistant	105	3 00	315 00	
W. E. Brown	Inspector	115	3 00	345 00	
Thomas O'Connor	Inspector	167	3 00	501 00	
Marcellus Smith	Inspector	69	4 00	276 00	
O. H. Moore	Inspector	115	3 00	345 00	
John Somers	Inspector	138	4 00	552 00	
Robert Coleman	Inspector	52	4 00	208 00	
M. D. Sherrill	Inspector	52	3 00	156 00	
G. W. Baxter	Inspector	52	3 00	156 00	
					$8,226 00
	Incidental expenses.				
	Stationery	......	....	$344 10	
	Fuel	......	....	74 68	
	Light	......	....	16 05	
	Office rent	......	....	140 00	
	Postage and telegraph	......	....	84 84	
	Miscellaneous	......	....	58 32	
					717 99
	Total	......	....	....	$8,943 99

TABLE No. 1 — (Continued).

CONSTRUCTION FISH CREEK FEEDER.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
W. B. Cooper	Assistant engineer	52	$5 00	$260 00	
S. E. Babcock	Assistant engineer	79	5 00	395 00	
W H. Newkirk	Leveler	73	4 00	292 00	
G. N. Smith	Rodman	79	3 00	237 00	
Stephen Thorn	Rodman	79	3 00	237 00	
Nat. B. Ward	Chainman	79	2 50	197 50	
E. B. Harrington	Axman	52	2 50	130 00	
George Lawrence	Axman	3	2 00	6 00	
Silas Wright	Flagman	26	3 00	78 00	
A. H. Holbrook	Flagman	79	3 00	237 00	
John O'Hara	Assistant	52	4 00	208 00	
Richard Felton	Laborer	8	2 00	16 00	
John Graves	Laborer	8	2 00	16 00	
					$2,309 50
	Incidental expenses.				
	Stationery	......	....	$156 84	
	Fuel	......	....	6 15	
	Office rent	......	....	70 00	
	Postage and telegraph	......	....	5 74	
	Miscellaneous	......	....	184 48	
					373 21
	Total Fish Creek feeder	......	....	....	$2,682 71

ENLARGEMENT CHAMPLAIN CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
W. B. Cooper	Assistant engineer	79	$6 00	$474 00	
S. E. Babcock	Assistant engineer	79	6 00	474 00	
Isaiah Fuller	Assistant	79	6 00	474 00	
R. J. Hilton, Jr	Transitman	79	5 00	395 00	
Stephen Thorn	Transitman	79	5 00	395 00	
B. H. Brevoort	Topographer	53	5 00	265 00	
H. K. Averill, Jr.	Topographer	79	5 00	395 00	
E. B. Crane	Leveler	20	4 00	80 00	
W. H. Newkirk	Leveler	66	4 00	264 00	
Edwin Hall	Leveler	26	4 00	104 00	
C. W. M. Johnson	Surveyor	17	3 00	51 00	
Edwin Hall	Rodman	53	3 00	159 00	
W. F. Potter	Rodman	79	3 00	237 00	
A. D. Robinson	Rodman	79	3 00	237 00	
Nat. B. Ward	Rodman	79	3 00	237 00	
C. O Green	Chainman	79	3 00	237 00	
M. J. Manning	Chainman	79	3 00	237 00	
W. E. Brown	Chainman	79	3 00	237 00	
Thomas O'Connor	Chainman	79	3 00	237 00	
John L. Woodin, Jr	Tapeman	79	2 00	158 00	
C. D. G. Waters	Tapeman	79	2 00	158 00	
Jas. Langworthy	Tapeman	44	2 00	88 00	
C. H. Sherrill	Tapeman	79	2 00	158 00	
C. H Bishop	Tapeman	45	2 00	90 00	
R. W. Wilson	Tape and axman	17	2 50	42 50	
G. A. Toole	Tape and axman	79	2 50	197 50	
O. H. Moore	Axman	79	2 50	197 50	
Martin Joyce	Axman	65	2 50	162 50	
Martin Kiley	Axman	26	2 50	65 00	
John Tate	Axman	71	2 50	177 50	
G. C. Squires	Flagman	79	2 50	197 50	
John Pike	Flagman	79	2 50	197 50	
W. H. Hand	Flagman	79	2 50	197 50	
A. H. Holbrook	Flagman	79	2 50	197 50	
Charles Van Derkar	Inspector	4	4 00	16 00	
John Davidson	Laborer	2½	2 00	5 00	
Timothy Green	Laborer	3½	2 00	7 00	
Michael Kane	Laborer	3½	2 00	7 00	
Jerry Dwyer	Laborer	3½	2 00	7 00	
Thomas Murray	Laborer	3½	2 00	7 00	
James Gill	Laborer	3½	2 00	7 00	
John Kane	Laborer	5	2 00	10 00	
George Griffin	Laborer	2	3 00	6 00	
A. P. Van Derkar	Laborer	5	3 00	15 00	
C. H. Bonnce	Laborer	2	3 00	6 00	
					$7,566 50
	Incidental expenses.				
	Stationery	......	....	$239 94	
	Miscellaneous	......	....	1,642 58	
					1,882 52
	Total enlargement Champlain canal	......	....	....	$9,449 02

TABLE No. 1—(Continued).

EXTRAORDINARY REPAIRS ERIE CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
John A. Cooper	Draughtsman	313	$5 00	$1,565 00	
Charles M. Thompson	Assistant in office	313	5 00	1,565 00	
G. F. Oliver	Assistant engineer	313	5 00	1,565 00	
R. J. Cantwell	Assistant engineer	63	4 50	283 50	
R. J. Cantwell	Assistant engineer	155	5 00	775 00	
M. H. Roberts	Assistant draughtsman	79	4 00	316 00	
G. M. Barnes	Assistant engineer	105	5 00	525 00	
B. H. Brevoort	Assistant engineer	260	5 00	1,300 00	
J. A. Allen	Assistant engineer	120	4 00	480 00	
J. A. Allen	Assistant engineer	157	4 50	706 50	
F. J. Harris	Rodman	313	3 00	939 00	
E. H. Ball	Leveler	194	4 00	776 00	
Samuel Moak	Leveler	105	3 50	367 50	
S. E. Babcock	Assistant engineer	155	5 00	775 00	
Joseph French	Assistant engineer	36	5 00	180 00	
G. W. Chase	Assistant engineer	111	4 00	444 00	
M. A. Campion	Rodman	151	2 50	377 50	
J. F. McQuade	Rodman	114	2 50	285 00	
W. B. Coleman	Rodman	79	3 50	276 50	
Myron Wilcox	Rodman	16	2 50	40 00	
E. B. Harrington	Rodman	4	2 50	10 00	
A. H. Holbrook	Chainman	95	3 00	285 00	
Thomas McQuade	Tapeman	114	2 50	285 00	
F. J. Harding	Tapeman	29	2 50	72 50	
N. B. Ward	Axman	115	2 50	287 50	
Dana Reed	Inspector	313	4 00	1,252 00	
Edward Vaughn	Inspector	234	4 00	936 00	
Robine Hathaway	Inspector	125	4 00	500 00	
Alexander Robertson	Inspector	92	4 00	368 00	
L. L. Lowell	Inspector	234	4 00	936 00	
Edwin Sears	Inspector	79	4 00	316 00	
M. J. Manning	Inspector	19	3 00	57 00	
Amasa Keith	Inspector	38	4 00	152 00	
Gaylord Campbell	Inspector	36	3 00	108 00	
Thomas C. Jeffers	Inspector	65	4 00	260 00	
					$19,366 50
	Incidental expenses.				
	Stationery	......	....	$687 90	
	Office rent	......	....	142 99	
	Light	......	....	17 75	
	Fuel	......	....	81 81	
	Postage and telegraph	......	....	242 05	
	Miscellaneous	......	....	50 10	
					1,222 60
	Total extraordinary repairs Erie	......	....	....	$20,589 10

EXTRAORDINARY REPAIRS CHAMPLAIN CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
W. B. Cooper	Assistant engineer	53	$5 00	$265 00	
W. B. Cooper	Assistant engineer	26	6 00	156 00	
H. A. Smith	Leveler	182	3 25	591 00	
H. A. Smith	Leveler	105	4 00	420 00	
M. McNaughton	Rodman	115	3 00	345 00	
Gales Coleman	Inspector	194	4 00	776 00	
Stephen Thorn	Rodman	77	3 00	231 00	
George Cushing, Jr.	Assistant engineer	313	5 00	1,565 00	
James Ray	Inspector	17	4 00	68 00	
L. J. Carrington	Inspector	104	3 50	364 00	
					$4,781 50
	Incidental expenses.				
	Stationery	......	....	$288 50	
					288 50
	Total extraordinary repairs Champlain	......	....	....	$5,070 00

EXTRAORDINARY REPAIRS BLACK RIVER CANAL.

NAMES.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
L. L. Nichols (water sur.)	Assistant engineer	79	$8 00	$632 00	
C. L. Phelps	Assistant engineer	196	4 00	784 00	
					$1,416 00
	Total extraordinary repairs Black River canal	......	....	....	$1,416 00

SUMMARY OF TABLE No. 1.

NAME OF CANAL.	Engineering proper.	Incidental expenses.	Amounts.	Total.
Repairs Erie canal	$3,076 86	$217 92	$3,294 78	
Repairs Champlain canal	1,933 82	....	1,933 82	
Repairs Black River canal	784 92	....	784 92	$6,013 52
Improvement Champlain canal	8,226 00	717 99	$8,943 99	
Construction Fish Creek feeder	2,309 50	373 21	2,682 71	
Enlargement Champlain canal	7,566 50	1,882 52	9,449 02	21,075 72
Amount paid by Division engineer	....	....	....	$27,089 24
Extraordinary repairs Erie canal	19,366 50	1,222 60	$20,589 10	
Extraordinary repairs Champlain canal	4,781 50	288 50	5,070 00	
Extraordinary repairs Black River canal	1,416 00	....	1,416 00	
Amount paid by Canal Commissioner	....	....	....	27,075 10
Total expenses for engineering	....	....	....	$54,164 34

TABLE No. 2.

STATEMENT showing the length in miles, number of structures, estimated cost at contract prices, amount of work done for the fiscal year ending Sept. 30, 1870, whole amount of work done, and work completed or settled, with the characteristic detail of contracts existing upon the Eastern Division of the New York State Canals, for the fiscal year ending Sept. 30th, 1870.

EXTRAORDINARY REPAIRS—ERIE CANAL.

Work let by Canal Commissioners—Laws of 1868.

Length in miles.	Number of structures.	CHARACTER OF WORK.	Estimated cost at contract prices.	Amount done during fiscal year ending Sept. 30, 1870.	Whole amount done.	Amount remaining to be done.
0.17	....	Removing slope wall and wall bench and constructing docking at Rome ...	$3,694 11	$3,694 11	$3,694 11	Settled.
....	1	Removing iron bridge from Washington to George street and constructing iron bridge at Washington street, Rome	11,186 86	11,186 86	11,186 86	Settled.
....	1	Raising and repairing Troy dam	21,964 18	4,984 18	21,964 18	Settled.
3.75	....	Removing slope wall, &c., from lock No. 20 to a point one mile above upper Mohawk aqueduct........	68,700 92	19,580 92	68,700 92	Settled.
3.30	....	Removing slope wall, &c., from lock No. 2 to Port Schuyler........	57,884 65	23,524 65	57,884 65	Settled.
....	1	Rebuilding lock No. 2........	30,355 00	....	840 00	$29,515 00
		Laws of 1869.				
....	1	Iron foot bridge at Utica........	2,503 15	2,503 15	2,503 15	Settled.
....	1	Iron side walk bridge at Cohoes........	1,401 00	....	....	1,401 00
....	1	Iron road bridge at Spraker's basin........	1,520 00	1,520 00	1,520 00	Settled.
....	1	Sluice at Cohoes guard lock........	1,696 00	....	....	1,696 00
....	1	Iron road bridge, with tow-path bridge attached, at Oneida street, Cohoes.	6,155 71	6,155 71	6,155 71	Settled.
....	1	Wooden bridge at Ilion........	6,440 00	5,240 00	5,240 00	1,200 00
0.30	....	Wall bench and vertical wall at Utica	13,497 00	11,180 00	11,180 00	2,317 00
....	1	Upper lock at upper side-cut, West Troy........	33,260 00	1,040 00	1,040 00	32,220 00
....	1	Lower lock at upper side-cut, West Troy........	33,635 00	700 00	700 00	32,935 00
5.50	....	Removing wall bench, &c., from Port Schuyler to lower aqueduct........	78,520 00	78,520 00	78,520 00	....
3.75	....	Removing wall bench, &c., from lock No. 43 to lock No. 45........	41,720 00	41,720 00	41,720 00	....
....	1	Stone dam across the Hudson river at Troy........	57,140 00	....	....	57,140 00
3.25	....	Removing wall bench, &c., from lower aqueduct to lock No. 20........	23,405 00	7,100 00	7,100 00	16,305 00
		Laws of 1870.				
....	1	Wrought iron bridge at Railroad street, Ilion........	4,114 96	4,114 96	4,114 96	Settled.
....	1	Cast iron road and tow-path bridge attached, at south end lower Mohawk aqueduct........	7,940 00	7,940 00	7,940 00	Settled.

2.75	....	Removing wall bench, &c., from Canajoharie to Fort Plain	19,830 00	....	....	19,830 00
2 90	....	Removing wall bench, &c., from lock 40 to 41	21,730 00	....	....	21,730 00
2.75	....	Removing wall bench, &c., from lock 41 to 42	20,345 00	....	....	20,345 00
0.21	....	Removing wall bench, &c., on berme and tow-path sides at Rome	5,563 25	....	....	5,563 25
....	1	Removing wall bench, &c., and constructing vertical wall on the berme side in Utica	2,828 00	....	....	2,828 00
....	1	Lengthening culvert at Frankfort	1,174 60	....	....	1,174 60
....	1	Cast iron bridge at Fonda street, Schenectady	2,356 75	....	....	2,356 75
....	1	Cast iron bridge at Schuyler street, Utica	2,376 00	....	....	2,376 00
		Total under contract	$582,937 10	$230,704 54	$332,004 54	$250,932 60
		Work done by Canal Commissioner.				
....	....	Removing wall bench, &c., from lock No. 20 to a point one mile above upper Mohawk aqueduct	$3,820 00	$3,820 00	$3,820 00	....
0.30	....	Removing original bottom at Oriskany	2,000 00	2,000 00	2,000 00	....
....	1	Waste-weir and deepening Dry river, Schenectady street, West Troy	5,394 86	5,394 86	5,394 86	....
....	....	Vertical wall across the basin at Canajoharie	2,220 00	2,220 00	2,220 00	....
....	....	Constructing two farm bridges over, and a ditch adjacent to Rocky Rift feeder	1,000 00	1,000 00	1,000 00	....
....	....	Lengthening west abutment White street bridge, Cohoes	586 48	586 48	586 48	....
....	....	Removing wall bench, &c., and constructing 625 lineal feet docking on berme side at Rome	3,845 08	3,845 08	3,845 08	....
....	....	Inserting tumble gates at locks 44 and 45	9,000 00	9,000 00	9,000 00	....
		Total not under contract	$27,866 42	$27,866 42	$27,866 42	....
		Total under and not under contract	$610,803 52	$258,570 96	$359,870 92	$250,932 60

EXTRAORDINARY REPAIRS—CHAMPLAIN CANAL.

Work let by the Canal Board, Chapter 579, Laws of 1867.

....	1	Stone dam at Cohoes (excess over wooden dam)	$50,000 00	$50,000 00	$50,000 00	....
		Work let by Canal Commissioners.				
....	1	Bridge at McIntyre street, Fort Edward	3,449 12	789 12	3,449 12	Settled.
....	1	Farm bridge of G. F. Dudley	588 28	168 28	588 28	Settled.
....	1	Farm bridge of L. A. Weaver	1,332 21	512 21	1,332 21	Settled.

TABLE No. 2—(Continued).

Length in miles.	Number of structures.	CHARACTER OF WORK.	Estimated cost at contract prices.	Amount done during fiscal year ending Sept. 30, 1870.	Whole amount done.	Amount remaining to be done.
	1	Road bridge at Mechanicsville	$1,492 76	$492 76	$1,492 76	Settled.
		Dredging Whitehall basin	23,800 00	17,200 00	23,800 00	
		Under Chapter 877, Laws of 1869.				
	1	Hewitt's lock (excess over old plan)	17,000 00	17,000 00	17,000 00	Settled.
	1	Glen's Falls feeder lock (excess over old plan)	10,000 00	10,000 00	10,000 00	
	1	Saratoga dam (excess over wooden dam)	27,000 00	1,340 00	1,340 00	$25,660 00
	1	Sluice at Saratoga guard lock	7,423 79	7,423 79	7,423 79	Settled.
0.20		Improvement at Schuylerville	7,068 87	7,068 87	7,068 87	Settled.
	1	Vertical wall and stop gate at Fort Edward	9,680 00	9,680 00	9,680 00	
	1	Wrought iron road bridge over Glen's Falls feeder at Green's crossing	1,631 85	1,631 85	1,631 85	Settled.
		Under Chapter 767, Laws of 1870.				
	1	Flynn's lock, enlarged size (excess over old plan)	17,000 00			17,000 00
		Vertical wall on berme and tow-path side, Glen's Falls feeder at Sandy Hill	6,650 00			6,650 00
		Improvement at Waterford	4,322 00			4,322 00
	1	Dam across Hudson river head of Glen's Falls feeder	33,003 00			33,003 00
	1	Wrought iron road bridge (tow-path and sidewalk attached) at Fort Edward,	5,010 00			5,010 00
		Total under contract	$226,451 88	$123,106 88	$134,806 88	$91,645 00
		Work done by Canal Commissioner.				
		Digging ditch from canal to Wood creek, above Fort Edward	$211 20	$211 20	$211 20	
		Docking on berme side at Fort Ann	2,565 00	2,565 00	2,565 00	
		Docking on berme side of feeder at Glen's Falls	539 37	539 37	539 37	
		Vertical wall on berme side of feeder at Glen's Falls	1,385 05	1,385 05	1,385 05	
		Vertical wall and removing rock bottom Glen's Falls feeder at Sandy Hill	3,464 31	3,464 31	3,464 31	
		Vertical wall at foot of combined locks, Glen's Falls feeder	2,099 68	2,099 68	2,099 68	
		Vertical wall on tow-path side above Fort Edward lock	3,368 56	3,368 56	3,368 56	
		Vertical wall on berme side at Ames' mills, Whitehall	314 25	314 25	314 25	
		Total not under contract	$13,947 42	$13,947 42	$13,947 42	
		Total under and not under contract	$240,399 30	$137,054 30	$148,754 30	$91,645 00

EXTRAORDINARY REPAIRS—BLACK RIVER CANAL.

Work let by Canal Board, under Chapter 579, Laws of 1867.

....	....	Improvement first level at Rome	$6,281 73	$1,340 00	$4,600 00	$1,681 73
		Work let by Canal Commissioners, Laws of 1869.				
....	1	Bridge over Black River at Parker's landing	15,996 00	10,720 00	10,720 00	5,276 00
....	1	Bridge over Black River canal at Port Leyden	707 50	560 00	560 00	147 50
....	1	Iron road bridge at Floyd street, Rome	4,743 00	1,900 00	1,900 00	2,843 00
		Laws of 1870.				
....	....	Iron bridge at Schuyler street, Booneville	1,625 50	....	....	1,625 50
....	....	Iron bridge at Dominick street, Rome	2,007 50	....	....	2,007 50
		Work done by Canal Commissioner.				
....	....	Cast iron discharge pipes at Woodhull reservoir	2,500 00	2,500 00	2,500 00	....
		Total Black River canal	$33,861 23	$17,020 00	$20,280 00	$13,581 23

IMPROVEMENT CHAMPLAIN CANAL.

Work let by Canal Commissioners, under Chapter 186, Laws of 1864.

2.60	....	From Saratoga lock to Fort Miller lock	$20,236 00	....	$6,340 00	$13,896 00
2.65	....	From Fort Miller lock to Moses Kill lock	21,895 00	$5,520 00	16,000 00	5,895 00
5.50	....	From Moses Kill lock to Fort Edward lock	88,240 00	47,500 00	88,240 00	....
4.08	....	Section No. 2, 12-mile level	48,060 00	22,900 00	48,060 00	....
3.50	....	Section No. 3, 12-mile level	53,440 00	35,340 00	53,440 00	....
		Under Chapter 715, Laws of 1868.				
1.55	....	Raising and paving towing-path on Wood creek from lower lock at Fort Ann to the Narrows	23,478 40	4,513 40	23,478 40	Settled.
3.05	....	Raising and paving towing-path on Wood creek from Parish lock to guard lock	48,886 00	12,126 00	48,886 00	Settled.
		Under Chapter 877, Laws of 1869.				
4.00	....	Section No. 1, 12-mile level, raising and lining towing-path	1,872 00	....	....	1,872 00
5.50	....	Whitehall level	22,560 00	20,040 00	20,040 00	2,520 00
4.00	....	Raising road-bed adjacent to Wood creek	14,460 00	5,180 00	14,460 00	Settled.
......	1	Improving the Narrows on Wood creek	8,794 64	954 64	3,794 64	Settled.
......	....	Raising and lining towing-path on Whitehall level	8,172 20	2,492 20	8,172 20	Settled.
		Total improvement Champlain canal	$348,589 24	$156,566 24	$325,406 24	$23,188 00

TABLE No. 3.

STATEMENT showing amount of work done under the supervision of the Engineer Department, on repairs, under contract and on extraordinary and miscellaneous repairs upon the Eastern Division of the New York State Canals, for the fiscal year ending September 30th, 1870.

ORDINARY REPAIRS—ERIE CANAL.

Length in miles.	Number of structures.	CHARACTER OF WORK.	Estimated cost at contract prices.	Amount done during fiscal year ending Sept. 30, 1870.	Whole amount done.	Amount remaining to be done.
......	1	Cast-iron bridge at Fonda street, Schenectady (estimated cost of old plan chargeable)	$1,100 00	....	....	$1,100 00
......	1	Cast-iron bridge at Schuyler street, Utica (estimated cost of old plan chargeable)	971 00	....	....	971 00
......	1	Dredging Albany basin	93,819 50	$93,819 50	$93,819 50	....
		Total	$95,890 50	$93,819 50	$93,819 50	$2,071 00

CHAMPLAIN CANAL.

Length in miles.	Number of structures.	CHARACTER OF WORK.	Estimated cost at contract prices.	Amount done during fiscal year ending Sept. 30, 1870.	Whole amount done.	Amount remaining to be done.
......	1	Stone dam at Cohoes (chargeable to repairs)	$66,440 00	$34,760 00	$66,440 00	....
......	1	Saratoga dam (chargeable to ordinary repairs, as per Engineer's estimate)	46,754 00	....	....	$46,754 00
......	1	Glen's Falls feeder guard lock (chargeable to ordinary repairs, as per Engineer's estimate)	21,980 00	21,980 00	21,930 00	....
......	1	Hewitt's lock (chargeable to ordinary repairs)	23,959 99	23,959 99	23,959 99	Settled
......	1	Flynn's lock (chargeable to ordinary repairs, as per Engineer's estimate	20,495 00	....	....	20,495 00
......	1	Dam across the Hudson, head of Glen's Falls feeder (chargeable to ordinary repairs, as per Engineer's estimate)	44,891 00	....	....	44,891 00
......	1	Wrought-iron road bridge over Glen's Falls feeder, at Green's crossing (cost of old plan chargeable)	450 00	450 00	450 00	Settled.
		Total	$224,969 99	$81,149 99	$112,820 99	$112,140 00

BLACK RIVER CANAL.

Work done by Canal Commissioner.

Length in miles.	Number of structures.	CHARACTER OF WORK.	Estimated cost at contract prices.	Amount done during fiscal year ending Sept. 30, 1870.	Whole amount done.	Amount remaining to be done.
......	1	Reconstructing North Branch reservoir	$97,033 81	$36,936 00	$97,033 81	....
......	1	Cast-iron discharge pipes at Woodhull reservoir	9,090 00	....	....	$9,090 00
......	1	Iron bridge at Dominick street, Rome (cost of old plan chargeable, as per Engineer's estimate)	800 00	....	....	800 00
		Total	$106,923 81	$36,936 00	$97,033 81	$9,890 00

SUMMARY OF TABLES Nos. 2 and 3.

NAME OF CANAL.	Estimated cost at contract prices.	Amount done during the fiscal year ending Sept. 30, 1870.	Whole amount done.	Amount remaining to be done.
Extraordinary repairs Erie canal	$610,803 52	$258,570 96	$359,870 92	$250,932 60
Extraordinary repairs Champlain canal	240,399 30	137,054 30	148,754 30	91,645 00
Extraordinary repairs Black River canal	33,861 23	17,020 00	20,280 00	13,581 23
Total	$885,064 05	$412,645 26	$528,905 22	$356,158 83
Improvement Champlain canal	$348,589 24	$156,566 24	$325,406 24	$23,183 00
Total	$348,589 24	$156,566 24	$325,406 24	$23,183 00
Ordinary repairs Erie canal	$95,890 50	$93,819 50	$93,819 50	$2,071 00
Ordinary repairs Champlain canal	224,969 99	81,149 99	112,829 99	112,140 00
Ordinary repairs, Black River canal	106,923 81	36,936 00	97,033 81	9,890 00
Total	$427,784 80	$211,905 49	$303,683 30	$124,101 00
Grand total	$1,661,437 59	$781,116 99	$1,157,994 76	$508,442 83

MIDDLE DIVISION.

ANNUAL REPORT OF M. S. KIMBALL, DIVISION ENGINEER, FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1870.

Hon. Van R. Richmond, *State Engineer and Surveyor:*

Sir.—I have the honor to present you the following report:

LENGTH OF COMPLETED CANALS.

	Miles.
Erie canal 68.58, navigable feeders 3.35	71.93
Oneida Lake canal and feeder (old)	7.00
Oswego canal	38.00
Oneida river improvement	20.00
Seneca river towing-path	5.75
Baldwinsville canal and improvement to Jack's Reef	12.50
Cayuga and Seneca canal	22.77
Crooked Lake canal	8.00
Chemung canal and feeder	39.00
Cayuga inlet	2.00
Chenango canal	97.00
	323.95

RESERVOIRS AND FEEDERS.

For the Erie Canal.—Erieville reservoir, 340 acres, 21½ feet deep; De Ruyter reservoir, 626 acres, 18½ feet deep; Cazenovia lake, 1,778 acres, 4½ feet deep; Skaneateles lake, 8,320 acres, 7 feet deep; Otisco lake, 2,200 acres, 10 feet deep; Owasco lake, 6,800 acres, 2½ feet deep; and Oneida, Cowasselon, Chittenango, Carpenter Brook, Jordan, Weedsport and Port Byron feeders.

For the Chenango Canal.—Madison Brook reservoir, 235 acres, 45 feet deep; Bradley Brook reservoir, 134 acres, 25 feet deep; Eaton Brook reservoir, 254 acres, 50 feet deep; Hatch's lake, 134 acres, 10 feet deep; Woodman's pond, 148 acres, 11 feet deep; Leland's pond, 173 acres, 8 feet deep; and Kingsley Brook reservoir, 113 acres, 20 feet deep.

ENGINEERING DEPARTMENT.

The Middle Division has been in charge of M. S. Kimball, as Division Engineer, and Howard Soule, Jr., Resident.

Table No. 1

Is an exhibit in detail of the cost of engineering for all of the work.

The following statement shows the total amount of work done during the year, to total cost of engineering, and the percentage of cost of the same.

NAME OF CANAL.	Work done.	Engineering.	Percentage.
Erie canal	$201,056 60	$11,171 89	5.55
Oswego	70,589 69	3,983 25	5.64
Chenango	83,146 46	3,030 19	3.64
Chenango extension	303,759 18	23,566 98	7.76
Chemung	70,846 60	2,930 16	4.14
Crooked Lake	....	295 70	....
Cayuga and Seneca	56,865 75	3,632 70	6.39
Oneida Lake (enlargement)	199,440 00	5,231 89	2.62
Otisco Lake reservoir	23,940 00	1,580 01	6.60
Baldwinsville canal	3,912 70	....	....
	$1,013,556 98	$55,422 27	5.47

The aggregate cost of engineering is increased $10,945.47 this year over last. $5,090.78 occurs on the Chenango Canal extension, and is attributable to the cost of surveying and estimating on three different lines, from section 30 down, the location on one of which was definitely settled, and the work let. $3,757.70 is an increase on the Erie canal, owing both to the cost of surveying for new reservoirs and an increase of inspectors on the work in progress. The balance, $2,069.99, is distributed among other canals, the increase being generally for inspectors; although the aggregate of engineering is increased, yet the percentage of cost on the whole amount of work done is lessened from 7.30 per cent last year to 5.47 this.

Tables Nos. 2 and 3.

Table 2 shows the total work under contract, the amount done during the fiscal year, the total amount done, and the work remaining to be done on all the canals and works of the Middle Division, except certain other work not under contract, which is shown in table 3.

ERIE CANAL.

On the ten old contracts $82,840 worth of work has been done this year, but none completed and settled. Six new contracts have been made, $21,815 done, and two made, completed and settled, amounting to $4,179.87. The cost to complete the sixteen is $119,662.90.

Table three shows two works authorized by special laws, amounting to $38,250.87; six by Canal Commissioner, on change of plan (authorized by act chapter 767, Laws of 1870), $27,607.67, and three under repair contractor's contracts, $50,303.19.

One hundred and two chains of bench-wall at Jordan, on the towpath, and 140 at Memphis, was taken up and relaid with slope-wall from bottom to top last winter, together with one and one-half chains of vertical wall, at a cost of $39,820. There remains 1820 chains of single slope wall, and forty of vertical, to complete the Jordan level, at a cost of $311,280. There has been paid $33,847, and there is on hand $46,153, leaving a balance of $265,127, which, together with the amount due on work done of $5,973, leaves the amount to be appropriated to fully complete, $271,100.

Fifty-six chains of vertical wall was built on the Syracuse level, at a cost of $17,300, and there remains sixty-four chains of slope and ninety-nine of vertical to complete, at a cost of $41,087. There has been paid $14,705, and there is on hand $32,295, leaving a balance of $8,795, which, together with the amount due on work done of $2,595, leaves the amount to be appropriated to fully complete, $11,387.

Seventy chains of slope wall was built on the long level and twenty-two of vertical, at a cost of $14,640, and there remains 360 of slope, and fifteen of vertical to complete, at a cost of $65,622. There has been paid $12,444, and there is on hand $15,556, leaving a balance of $50,066, which, together with the amount due on work done of $2,196, leaves the amount to be appropriated to fully complete, $52,262.

Of the bottoming down on the long level, 290 chains have been done, including the lowering of the railroad tunnel, costing $34,340.62. There remains 150 chains, estimated as costing $11,525. There has been paid $34,340.62, and there is on hand $3,534.13, leaving a balance of $7,990.87 to be appropriated.

Chap. 767, Laws of last winter, provided $20,000 for widening locks 47 and 48 at Lodi, and $20,000 for stop gates on the long level, neither of which has as yet been contracted for.

With the Otisco and Owasco Lake reservoirs in operation, there has been no want of water on the Jordan and Port Byron levels. The feeder trunk, however, and the feeder proper, two miles long at Port Byron, are both in a bad state of repair. The feeder proper is nothing but a narrow mill race, built in the side hill high above the flats, and is a source of constant expense to keep in order. The feeder trunk is an extension of the race mounted on bents, and no better.

In relation to the long level, although there has been no breaks in the banks or structures, yet we have come so near being detained from another cause, that I must mention it. The season has been a hot and dry one, and precautions were taken at all times to save the water in the reservoirs. The Erieville, however, was emptied quite in the early part of the season. The Cazenovia so nearly so about the middle of October, that the superintendent made preparations to lower the bottom a foot, but just at this time there came rains that saved him that trouble and expense. The De Ruyter was drawn down 15 feet (by far the most valuable part). These things being so, brings me to again call attention to the want of more water. Last year I reported the cost of reservoirs on the Butternut, six miles from Syracuse. I can say now that a reservoir above Jamesville can be got much larger than reported then; although the drainage basin would remain 30,000 acres, the reservoir surface can be increased to 240 acres, and the depth to 16 feet; giving 1,989 cubic feet per minute for 60 days, besides the natural stream; estimated to cost, including damages, $123,000; or without damages, $85,000.

OSWEGO CANAL.

On the eleven contracts in force last year, $5,642.04 of work has been done on two, and settled; on the remaining nine, $58,940 has been done. One new contract has been made, and $780 expended. The cost to complete the ten is estimated at $154,747.75.

Table 3 contains one work by Canal Commissioner on change of plan authorized by chap. 767, Laws of 1870, amounting to $4,171.56, and one under repair contractor's contract, $639.75.

The work done on the high dam, up to the close of the fiscal year, is $12,560. More will be done, say, $7,440, before the 1st of January; making the total, $20,000. This, deducted from the appropriation of $50,000, leaves a balance of but $30,000 on hand for the future work. Not over $5,000 of the expenditure this year goes to advance to new dam, the balance having gone to secure the old dam against threatened rupture at the west end. There should be an additional appropriation of at least $50,000 made this winter to forward the work another year.

The dam at Minetto will be closed across the river this fall. The remainder of the apron, about 150 feet, together with the extension of the abutments, will be done in another year, and completes the sixth stone dam on the Oswego river.

CHENANGO CANAL.

There were eight contracts on this canal last year. Four have been completed and settled, the work done this year being $48,257.31. Four have not been commenced, and three new ones have been added on which nothing has been done. The estimated cost to complete the seventh is $33,722.25.

Table 3 shows one work authorized by the Canal Board at $900, and one by the Canal Commissioners, under the repair contractor's contract, at $33,989.15.

The old contracts for locks 105, 106 and 107 being still in force, it is in contemplation to substitute 101 and 110 for 105 and 106, and add 108, they being the most defective ones in that locality, or on repair section 3; locks 50, 51 and 64, on repair section 1 and 84, 85 and 91, on section 2, were reported as necessary to be rebuilt last year. Of course the necessity is greater now. In general terms, all the locks of this canal not now rebuilt want overhauling. There are locks, however, many that can be rewooded, in my opinion, just as the plan at the time of the first construction of the canal designed they should be, and made to last another term over again.

The canal is an old one so far as woodwork is concerned. When built, although in a high style of art, yet some of the materials used, particularly stone, were of an inferior quality. Not only are locks failing, but aqueducts, culverts, waste-weirs and bridges; many of them need rebuiding now.

CAYUGA AND SENECA CANAL.

There were five contracts running on this canal last year. Two have been completed and settled, and the work done on them this year amounts to $12,111.30. Two new contracts have been added, completed and settled, costing $4,694.37, and one other work added on which $1,260 has been done. The estimated cost to complete the four contracts left is $18,601.

Table 3 contains one work by the Canal Commissioner amounting to $640.08, done under the repair contractor's contract.

The pier at Geneva was completed last year, before the setting in of winter, and a light-house put up on the outer end. Both are permanent and good structures, answering well the purposes for which they were built.

Locks 2, 3, 9 and 11, mentioned in last year's report, have been built. No. 3, at Seneca Falls, finished immediately at the opening, has been somewhat damaged by a failure in the goodness of the hydraulic lime used. The mortar washed out some and the walls leaned inward, but, the lock being over width, has not interrupted navigation. Whether the walls will have to be taken down and relaid, or any portion of them, cannot be determined until after the close.

Lock 11 was not completed until the 23d of June, owing to the high water, but, being on the Cayuga outlet, did not interrupt the main canal.

The appropriation of $10,000 last winter, for protecting the berme bank along Seneca lake, has been expended by the superintendent, but all that is necessary to secure the canal has not been accomplished. There should be an addition of a further sum of from $8,000 to $10,000 to fully complete it.

CHEMUNG CANAL.

There was but one contract in force at the close of the last fiscal year on this canal, and on which nothing had been done. The work has been done this year, amounting to $3,520, with $847.90 remaining to complete. Three new contracts have been made and added, and $5,100 done, and there remains of work to be done $27,375.

On the 19th of April last a flood in the Chemung river carried away 250 feet of the east end of the dam at Gibson, including the chute, together with 500 feet of length of pier docking forming the west side of the chute, and 300 feet forming the east side. Also 200 feet of docking at the head of the guard lock on the west side of the feeder, and 300 feet on the east, the waste-weir below, and a large quantity of embankment both above and below the guard lock and dam. Also raised up 130 feet in length of the apron of the dam left in, and carried out 400 feet in length of the high dock near Corning, and damaged 400 feet in length more.

The first thing to be done was to obtain navigation, and to do it it was necessary to build a coffer dam at once from the main dam around the break, 400 feet in length, and connect with the remains of the docking of the chute on the east side, rebuild the waste-weir below, restore the docking above, and rebuild and repair the dock near Corning, before raising the water. The coffer dam was made of crib-work, piles, brush, stone and earth, and when nearly done there came another flood, June 11th, and carried out 200 feet of it, besides damaging the remaining 200 feet, and cut down the bottom from twelve to fifteen feet below its natural bed. In replacing this coffer dam it was built much heavier, and an apron added supported on piles, and navigation opened on the 21st of July, since which time there has been no delay.

Up to this time nothing could be done nor was done toward rebuilding the main dam, except the delivery of materials. There was now the main dam of 250 feet, additional apron raised up that had to be taken up, piles driven and relaid 130 feet, several hundred feet in length of old chute to be taken up, the remainder of the crib-work docking to be put in and banked up, and several hundred feet in length of brush and stone to restore and protect the feeder banks farther down. All this must be done before the fall floods, to escape another disaster. Accordingly, large forces of men and teams were employed, and a competent engineer detailed, in the person of D. E. Whitford, to plan, lay out, and prosecute the work. It has been put forward at all times with correctness and dispatch, and now promises to be completed without any other failure.

The main dam has eight rows of piles driven variously from twenty to forty feet, capped with heavy oak, sheet piled, filled in with brush, stone and gravel, then timbered, planked and ironed over on the most substantial plan. The apron and crib-work docking is also supported on piles and finished up in the same manner.

CROOKED LAKE CANAL.

Locks 8, 9, 10 and 11, reported upon last year as being very bad, together with Nos. 18 and 19, are to be rebuilt this winter by the superintendent of repairs for this canal. He has already contracted for the materials, and much of the timber and stone have been brought on already.

Crooked lake became so low the latter part of the season that boats could not draw the regulation depth between the guard lock and the first lock, a mile and a half below. Chapter 767 of last winter appropriated $2,000 for bottoming down this level to correspond with the locks, and it should now be done.

ONEIDA LAKE CANAL.

Section 2 of this canal is completed practically, although the account is not settled. Sections 1, 3, 4 and 5 are about three-fourths done. The six locks are nearly finished, and the sooner water can be got on the better. The timber pier in the harbor at the lake is in place and mostly filled with stone, it should be completely and otherwise finished before the high water next spring. In addition to the other structures there should be two stone arch culverts added to prevent claims for damages for overflow of lands without them.

It was presumed in the report of last year that this canal would be finished and brought into use next spring. This will not now be done, the work having been suspended on account of the appropriation having become exhausted. The estimated cost of this canal was originally $258,000. A revision of the line and a more careful estimate of the quantities shows that several important items were omitted and others under-estimated, and that it amounts now to $314,000, or at increased prices established under relief bills, both of 1869 and 1870, to $416,000. The work done is $330,760, leaving remaining $85,240. To this should be added for engineering and contingencies, say $14,760, making $100,000 required to fully complete.

CAYUGA INLET.

The Legislature of 1869 appropriated $15,000, to be expended by the Canal Commissioners in building a towing-path, dredging the inlet, confining the waters of Fall creek within its own channel, repairing the old pier, and constructing a new one, to regulate the flow of water and prevent the formation of bars at the mouth of the inlet. Out of this appropriation there was expended, in 1869, $3,653.52 in constructing a towing-path on the west side of the inlet, and in confining the waters of Fall creek.

The dredging of the inlet, repairing the old, and constructing a new pier, was put under contract in 1869. Three hundred feet in length of new pier has been built, the old one partially repaired, and the balance of the appropriation expended in dredging the inlet. All has been done that was or could be contemplated under the contract in view of the small amount appropriated, which has been judiciously expended where the greatest benefit could be derived.

The present contract will soon be closed; but, in order to secure the object of the law, to wit, to prevent the formation of bars at the mouth of the inlet, and to obtain seven feet depth of water at all times, a farther appropriation of $15,000 is necessary to be expended in lengthening the new pier and in dredging the harbor and inlet.

BALDWINSVILLE CANAL.

Act, chapter 677, Laws of 1869, authorized and directed the Canal Board that whenever, in their judgment, it became necessary to rebuild the dam at Baldwinsville, it should be rebuilt with stone. Act, chapter 767, Laws of 1870, made an appropriation in conformity with chapter 677 of $6,000.

This dam, although old, is in a pretty fair condition from having been thoroughly repaired not long ago, with the exception of the extreme north end. Here the dam is covered for about thirty feet with a building, the spillway cut down and a water-power put in. The high water last spring undermined the bulkhead and water-wheels so much so that the State was not safe in risking a break at the next flood. The superintendent of repairs has therefore thrown around it a coffer dam calculated to make it secure, and it is now securing the dam.

There was one contract on this canal last year which has been completed and settled this year, the work done being $3,912.70.

GENERAL REMARKS.

Freedom from breaks, or other causes of detention to navigation on the division, the past year, has been the rule, not the exception. It was due mainly to the excellent system of police management, inaugurated and adopted for the first time in the history of the canals. Telegraph communication daily with the central office, at Syracuse, was had and kept up the entire season, showing, at all times, the stage of the water, and any other cause, either present or prospective, likely to affect the canals unfavorably. Having this, it was comparatively easy to apply the proper correction in time to avert any threatened calamity.

The canals generally may now be regarded as somewhat old. Much has been done, and is constantly doing, to repair and improve them. Many of the locks on the laterals have been rebuilt, changing the plan from wooden or composite to stone laid in cement, and many more require the same remodeling. Bridges have been changed from the plan of wood to those of iron. Many of the aqueducts now require, and many more will soon require, a rewooding of the trunks, and, in some cases, rebuilding of the masonry. The same may be said of the culverts and some other structures, though in a less degree.

The plan of putting the bottoming out on to the top of the tow-paths, adopted generally by the superintendents, with some reluctance, works well, and will eventually raise the low tow-paths to their proper heights. The result of bottoming down the long level east of Syracuse has shown a very marked improvement in the navigation, and should be completed. The same may be said of the removal of the bench-walls on the Jordan, Syracuse, and long levels, and the whole should be done for a more perfect canal.

Respectfully submitted.

M. S. KIMBALL,
Division Engineer.

EXTENSION OF THE CHENANGO CANAL.

To M. S. KIMBALL, *Division Engineer:*

At the close of the fiscal year, ending September 30th, 1869, the following work was under contract on the extension of the Chenango canal, namely: The river bank section at Binghamton, sections 1, 2, 3, 4, 5, 6 and part of 7, 10, 18, 20, 21, 26, 27 and 28; raising towing-path on sections 12, 13, 16, 22 and 23; locks Nos. 4, 5, 6, 7 and 8; Choconut, Tracy and Apalachin aqueducts; culverts on sections 1 to 20; culverts on sections 21 to 30; bridges on sections 1 to 10, and bridges on sections 11 to 23.

Since that time and during the fiscal year ending September 30th, 1870, the following work has been placed under contract, namely: On November 11th, 1869, sections 24, 25, 29 and 30; locks 1 and 3, Archibald aqueduct; bridges on sections 24 to 30, and the Binghamton dam and guard-lock; and on February 11th, 1870, sections 31 to 38, inclusive, and Pea Island dam.

The remaining uncompleted work between Binghamton and the State line not under contract is all below section No. 30, and is stated in table No. 4, as follows:

Four locks, three aqueducts, and culverts and bridges on sections Nos. 31 to 38, inclusive.

The contracts completed during the last fiscal year are sections Nos. 1, 10, 20, 21, lock No. 5, and Tracy aqueduct.

The contracts canceled during fiscal year are those for sections 3 and 18, the remaining work to be done on the former section being attached to section No. 4 by resolution of Canal Board, dated November 12th, 1869.

The completed contracts at the close of the fiscal year ending September 30th, 1870, are sections 1, 7 to 17, inclusive; 19 to 23, inclusive; lock No. 5, and Tracy aqueduct.

In the report of the preceding year it was stated that all the work on sections 24 to 30, and on locks Nos. 1 and 3 had then been awarded. Subsequently, however, November 11th, the following contracts were re-awarded, and are now included among those placed under contract *after* September 30th, 1869, namely: Sections 24, 25, 29 and 30, Archibald aqueduct; bridges on sections 24 to 30, and locks Nos. 1 and 3. Lock No. 2 is merged in locks Nos. 1 and 3, as stated in the preceding report.

But little now remains to complete the section work between Binghamton and Owego.

Many of the mechanical structures are also completed, and others nearly so.

A commencement was made on the Binghamton dam, by the delivery of a considerable quantity of materials, and only the failure of the appropriation prevented this work from being completed during the present year.

Below Owego the only section work done was upon sections 25 and 26. Materials were delivered for most of the mechanical structures as far as section 30, and lock No. 7 was half finished.

No contract work has been done as yet between section 30 and the State line.

In the preceding report it was stated that surveys were then in progress to ascertain the most suitable site for a dam across the Susquehanna river, and the best location for the canal below section No. 30, to the State line. These surveys were completed, and maps, estimates of cost, and a report were submitted to the Canal Board showing an examination of both sides of the river on five different lines, and three out of the many sites that were examined for the dam.

By resolution dated December 8th, 1869, the line marked "B" on the map was adopted, and the dam located at the Pea Islands, and the work directed to be put under contract.

Contracts for the dam and section work were entered into February

11th, 1870, but for want of funds no work has yet been commenced under them.

Table No. 2 has been increased over last year, by the addition of the new work which has been put under contract, and which has already been enumerated. Such portions of it as were then in No. 4, are now withdrawn from that table.

The new location below section 30, has changed the old arrangement somewhat of the numbers and names of the sections and structures, and in case of the dam has added a new item.

Bridges and culverts are also new items.

It is stated in the preceding report that the old estimates of cost are retained, except where the work has been put under contract. The old estimates were made previous to the suspension of 1867, and the revised estimates for obvious reasons which are given in the reports referred to, show an increase in amount.

The cost of sections 2, 4, 5, 6, 18 and 20 has been increased by the acts passed by the Legislature last winter, by which the Canal Board were directed to increase the amounts paid for the work, where the prices were found on proof to be below the cost of doing the same.

The cost of section 21 was increased by the large quantity of quicksand that was met with, and the heavy protection required on a portion of the section, both to guard the embankment from slides and to protect it from the force of the water and ice of the Susquehanna.

The transfer and addition of sections 31 to 38, Pea Island dam and the Binghamton dam and guard lock, also increase the aggregate over table No. 2, of last year.

A summary of table No. 2, for this year, is as follows:

Estimated cost at contract prices	$1,971,546 08
Amount done during fiscal year	303,759 18
Total amount done	1,377,574 69
Amount remaining to be done	593,971 39

Work under contract and completed, by table No. 2	$1,971,546 08
Work not under contract, by table No. 4	243,773 00
Total	$2,215,319 08
Total amount done	1,377,574 69
Remaining to be done	$837,744 39

Table No. 1 is an exhibit of the engineer and incidental expenses, and amounts to $23,566.98 or seven and three-fourths per cent of the work done during the fiscal year, being a slight increase over that of last year. The percentage would have been less in this than in any preceding year, but for the suspension of contract work in June last. Since that time a small force has been at work making up the final measurements and accounts on all the suspended or canceled contracts, on the first thirty miles of the canal.

Owing to the near exhaustion of the small appropriation made by the Legislature last winter for this canal, the contractors were notified in June last to suspend work. Some of them were afterward allowed to continue for a short time, in order to place the work in as safe a condition as the circumstances would permit.

Some necessary bridges were also completed or put in repair.

A large amount of superior timber was delivered for the various structures, which has been paid for at relative prices, and it is now in the care of the State. In order to preserve it, contracts were made for carefully piling and covering it. This work has been done, and it will be more valuable next year for the purposes designed, as it will then be well seasoned.

In closing I would remark that, with a sufficient appropriation, this canal could soon be brought into use. Another year would be sufficient to enable navigation to be open to Owego, and to nearly finish the remaining portion to the State line.

The greater portion of the work is now completed on the first thirty miles, which comprises the greater part of the expensive work.

Between Binghamton and Owego, where the dam across the Susquehanna is finished, there will be no structures or other work to complete requiring more time than one good summer season.

The principal structure below section 30 is the Pea Island dam across the Susquehanna, but with sufficient funds and proper management, this work could be completed within a year from its commencement. It is already under contract at very favorable rates for the State.

Much regret has been felt at the loss of the past season, which was remarkably favorable for work of all kinds, and especially in or near the river, which has been at its lowest stage for many months.

Attention has been called in the preceding reports, to the increased cost which is incurred by the suspension of work. This is due to various causes, one of the principal being the depreciation which ensues on unfinished work, caused by the action of floods, rains, etc. while it is in a comparatively unprotected state.

Much labor also becomes necessary at a further cost, in measurements, computing and preparing final accounts on suspended or canceled contracts, and again preparing them for reletting when the work is resumed.

Materials delivered are subject to loss from depreciation, accident, theft, etc., from being distributed over a great distance, also, a close care of them becomes diffcult.

The loss incurred by depreciation and other causes, as mentioned in this and preceding reports, occasioned by the suspension of the work for want of funds, and the importance of a speedy completion of this canal, to connect with the coal fields of Pennsylvania, the large amount of work already done, and the comparatively small outlay required to finish the canal, and the loss of interest or earnings on the amounts already expended, are urged as reasons why the Legislature should make a sufficient appropriation at the approaching session to speedily complete the work, and particularly to bring into use that portion now so nearly finished, comprised in the first thirty miles.

Very respectfully,

C. L. McALPINE,

Resident Engineer.

TABLE No. 1.

STATEMENT of engineering upon repairs of Middle Division of New York State canals, together with incidental expenses for the fiscal year, ending September 30th, 1870.

ERIE CANAL.

NAME.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
M. S. Kimball	Division engineer	Salary.	$2,400	$670 00	
M. S. Kimball	Division engineer	Travel.		195 00	
Howard Soule, Jr	Resident engineer	Salary.	2,000	805 00	
Howard Soule, Jr	Resident engineer	Travel.		220 16	
Incidental expenses.					$1,890 16
Stationery				$115 80	
Postage, telegraph, and express				206 05	
Fuel and light				98 31	
Miscellaneous				209 32	
					629 48
Total for Erie canal					$2,519 64

CAYUGA AND SENECA CANAL.

M. S. Kimball	Division engineer	Salary.	$2,400	$175 00	
M. S. Kimball	Division engineer	Travel.		47 96	
Howard Soule, Jr	Resident engineer	Salary.	2,000	370 00	
Howard Soule, Jr	Resident engineer	Travel.		96 00	
Incidental expenses.					$688, 96
Stationery				$10 55	
Postage, telegraph, and express				18 06	
					28 61
Total for Cayuga and Seneca canal					$717 57

CROOKED LAKE CANAL.

M. S. Kimball	Division engineer	Salary.	$2,400	$100 00	
M. S. Kimball	Division engineer	Travel.		40 00	
Howard Soule, Jr	Resident engineer	Salary.	2,000	100 00	
Howard Soule, Jr	Resident engineer	Travel.		20 00	
Incidental expenses.					$260 00
Stationery				$8 48	
Postage, telegraph, and express				27 22	
					35 70
Total for Crooked Lake canal					$295 70

CHEMUNG CANAL.

M. S. Kimball	Division engineer	Salary.	$2,400	$260 00	
M. S. Kimball	Division engineer	Travel.		100 40	
Howard Soule, Jr	Resident engineer	Salary.	2,000	300 00	
Howard Soule, Jr	Resident engineer	Travel.		105 54	
Incidental expenses.					$765 94
Stationery				$31 06	
Postage, telegraph, and express				27 54	
Miscellaneous				2 50	
					61 10
Total for Chemung canal					$827 04

TABLE No. 1—(Continued).

OSWEGO CANAL.

NAME.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
M. S. Kimball	Division engineer	Salary.	$2,400 00	$895 00	
M. S. Kimball	Division engineer	Travel.	....	289 16	
Howard Soule, Jr	Resident engineer	Salary.	2,000 00	75 00	
Howard Soule, Jr	Resident engineer	Travel.	....	20 84	$1,280 00
Incidental expenses					
Stationery				$16 53	
Postage, telegraph and express				8 87	
Office rent and fuel				24 45	
Miscellaneous				6 40	56 25
Total for Oswego canal				....	$1,336 25

CHENANGO CANAL.

NAME.	Rank.	No. of days.	Rate of compensation.	Amount.	Total.
M. S. Kimball	Division engineer	Salary.	$2,400 00	$300 00	
M. S. Kimball	Division engineer	Travel.	....	89 00	
Howard Soule, Jr	Resident engineer	Salary.	2,000 00	350 00	
Howard Soule, Jr	Resident engineer	Travel.	....	75 00	$814 00
Incidental expenses.					
Stationery				$40 43	
Postage, telegraph and express				28 76	69 19
Total for Chenango canal				....	$883 19
Total repairs Middle Division				....	$6,579 39

TABLE No. 1—(Continued).

STATEMENT of assistants employed upon ordinary and extraordinary repairs during the fiscal year ending September 30th, 1870, *and paid by the Canal Commissioner under act, chap.* 447, *Laws of* 1865.

NAME.	Canal.	No. of days.	Rate of compensation.	Amount.	Total.
Chas. A. Olmstead	Erie	16	$6 00	$96 00	
Chas. A. Sweet	Erie	129	5 00	645 00	
C. B. Morse	Erie	32	5 50	176 00	
W. D. Dunning	Erie	313	5 00	1,565 00	
Denison Richmond	Erie	313	5 00	1,565 00	
M. J. Dolphin	Erie	26	5 00	130 00	
E. L. Luddington	Erie	313	4 00	1,252 00	
John V. Norton	Erie	66	4 50	297 00	
John V. Norton	Erie	105	3 50	367 50	
Geo. S. Field	Erie	26	4 50	117 00	
Geo. S. Field	Erie	53	4 00	212 00	
A. D. Beach	Erie	26	4 00	104 00	
A. D. Beach	Erie	53	3 25	172 25	
Montgomery Pelton	Erie	5	3 50	17 50	
W. B. Platner	Erie	14	3 00	42 00	
P. P. Midler	Erie	54	5 00	270 00	
Chas. R. Breed	Erie	142	4 00	568 00	
Alexander Everts	Erie	92	4 00	368 00	
Joseph M. Kasson	Erie	41	4 00	164 00	
Barney Becker	Erie	94	4 00	376 00	
Chas. L. Richman	Erie	7	4 00	28 00	
James Delamater	Erie	32	3 00	96 00	
J. McMullen	Erie	6	2 50	15 00	
A. J. Van De Mark	Erie	1	2 00	2 00	

TABLE No. 1—(Continued).

NAME.	Canal.	No. of days.	Rate of compensation.	Amounts.	Totals.
Robert Dunlap, Jr.	Erie	1½	$2 00	$3 00	
Charles Brown	Erie	1	2 00	2 00	
W. A. Green	Erie	1	2 00	2 00	$8,652 25
H. H. Coats	Oswego	234	4 50	$1,053 00	
H. H. Coats	Oswego	79	3 50	276 50	
C. E. Smith	Oswego	79	4 00	316 00	
D. R. Brown	Oswego	97	4 00	388 00	
Joseph Wilbur	Oswego	17	3 50	59 50	
Isaac Thorp	Oswego	153	3 00	459 00	
Patrick Murphy	Oswego	38	2 50	95 00	2,647 00
D. E. Whitford	Chemung, and Cayuga and Seneca	313	5 00	$1,565 00	
Calvin Shelton	Chemung, and Cayuga and Seneca	234	3 75	877 50	
O. M. Claugharty	Chemung, and Cayuga and Seneca	79	3 75	296 25	
T. W. Amsbury	Chemung, and Cayuga and Seneca	79	3 50	276 50	
H. R. Wright	Chemung, and Cayuga and Seneca	221	3 00	663 00	
William Hoffman	Cayuga and Seneca	130	4 00	520 00	
Nathan Stevens	Cayuga and Seneca	78	4 00	312 00	
Hiram Titus	Cayuga and Seneca	48	4 00	192 00	
John V. Norton	Ithaca Inlet	13	4 00	52 00	
H. T. Beach	Chemung canal and feeder	23	4 00	92 00	
Geo. E. Runyan	Chemung canal and feeder	30	4 00	120 00	
John O'Hara	Chemung canal	13	4 00	52 00	5,018 25
Wm. V. Van Rensselear	Chenango	287	5 00	$1,435 00	
Egbert Bagg	Chenango	24	4 50	108 00	
Egbert Bagg	Chenango	67	4 00	268 00	
Chas. D. Smith	Chenango	112	3 00	336 00	2,147 00
	Total	......	....	....	$18,464 50

TABLE No. 1—(Continued).

STATEMENT of engineering upon construction of Oneida Lake canal, together with incidental expenses, for the fiscal year ending September 30th, 1870.

NAME.	Rank.	No. of days.	Rate of compensation.	Amounts.	Totals.
Thomas Goodsell	Assistant engineer	65	$5 00	$357 50	
H. D. Brockway	Leveler	157	4 50	706 50	
H. D. Brockway	Leveler	156	4 00	624 00	
F. G. Kelsey	Rodman	313	3 50	1,095 50	
S. S. Briggs	Axman	313	2 50	782 50	
H. C. Lower	Inspector	313	3 50	1,095 50	
J. H. McLaughlin	Inspector	136	3 00	408 00	
					$5,069 50
Incidental expenses.					
Stationery				$59 33	
Postage and telegraph				14 30	
Office rent, fuel and light				82 28	
Miscellaneous				5 98	
					161 89
Total for Oneida Lake canal				....	$5,231 39

TABLE No. 1—(Continued).

STATEMENT of engineering upon construction of Otisco Lake reservoir, together with incidental expenses, for the fiscal year ending September 30th, 1870.

NAME.	Rank.	No. of days.	Rate of compensation.	Amounts.	Totals.
Chas. A. Sweet	Assistant engineer	184	$5 00	$920 00	
Daniel Wade	Tapeman	170	3 00	510 00	
Ira Sherman	Chainman	11	2 50	27 50	
John Conway	Chainman	11	2 50	27 50	
Wm. Newman	Axman	3	2 50	7 50	
Herbert Tucker	Axman	8	2 50	20 00	
					$1,512 50
Incidental expenses.					
Sationery				$64 51	
Postage				3 00	
					67 51
Total for Otisco Lake reservoir				....	$1,580 01

TABLE No. 1—(Continued).

STATEMENT of engineering and incidental expenses upon extension of the Chenango canal, for the fiscal year ending September 30th, 1870, *as authorized by act, chap.* 185, *Laws of* 1864.

NAME.	Rank.	No. of days.	Rate of compensation.	Amounts.	Totals.
C. L. McAlpine	Resident engineer	Salary	$2,000 00	$2,000 00	
C. L. McAlpine	Resident engineer	Travel	....	560 76	
T. M. Sherman	Assistant engineer	231	5 50	1,270 50	
C. A. Beach	Assistant engineer	313	5 50	1,721 50	
O. F. Whitford	Leveler	234	4 50	1,053 00	
O. F. Whitford	Assistant engineer	79	5 50	434 50	
G. B. Yuille	Leveler	156	4 50	702 00	
G. B. Yuille	Assistant engineer	65	5 50	357 50	
G. B. Yuille	Additional pay	226	1 00	226 00	
E. M. Cafferty	Leveler	79	4 50	355 50	
L. F. Olney	Draftsman	81	4 50	364 50	
J. S. Killaly	Draftsman	203	4 50	913 50	
F. Leach, Jr	Rodman	79	4 00	316 00	
F. Leach, Jr	Leveler	234	4 50	1,053 00	
C. H. Hyde	Rodman	224	4 00	896 00	
H. T. Beach	Rodman	290	4 00	1,160 00	
G. S. Field	Rodman	234	4 00	936 00	
A. D. Beach	Tapeman	234	3 25	760 50	
T. J. Bristol	Tapeman	313	3 25	1,017 25	
O. Kellum	Tapeman	224	3 25	728 00	
O. C. Gay	Axman	79	2 75	217 25	
W. F. Lintz	Axman	25	2 75	68 75	
A. Van Wormer	Axman	53	2 75	145 75	
L. L. Johnson	Axman	26	2 75	71 50	
C. Curkendall	Axman	29	2 50	72 50	
F. Farrington	Flagman	244	3 00	732 00	
O. H. Wright	Flagman	6	3 00	18 00	
F. D. Philes	Clerk	244	3 00	732 00	
G. H. Sawyer	Inspector	79	4 00	316 00	
G. H Sawyer	Inspector	79	4 50	355 50	
G. H. Sawyer	Inspector	155	5 00	775 00	
B. Becker	Inspector	79	4 00	316 00	
H. Odell	Inspector	185	4 00	740 00	
H. Griswold	Inspector	79	3 50	276 50	
					$21,662 76
Incidental expenses.					
Labor				$42 25	
Stationery				236 88	
Fuel				87 85	
Light				64 60	
Office rent				317 50	
Postage and telegraph				115 61	
Miscellaneous				1,039 58	
					1,904 22
Total for the Chenango Canal extension				....	$23,566 98

SUMMARY OF TABLE No. 1.

Engineering proper for the whole division	$6,579 39
Engineering for repairs, ordinary and extraordinary	18,464 50
Engineering for the construction of the Oneida Lake canal	5,231 39
Engineering for the construction of Otisco Lake reservoir	1,580 01
Engineering for the Chenango Canal extension	23,566 98
	$55,422 27

TABLE No. 2.

STATEMENT of work under contract upon the Middle Division of the New York State Canals, for the fiscal year ending September 30th, 1870.

ERIE CANAL.

CHARACTER OF WORK.	Appropriation.	When let.	When to be completed.	Engin'rs estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.	Remarks.
Otisco Lake reservoir	$42,000	Oct. 1, 1868	Apr. 20, 1869	$42,000	$43,000 00	$23,940 00	$40,940 00	$2,060 00	
Improvement Owasco Lake outlet	21,500	July 22, 1868	Jan. 1, 1869	21,500	13,725 00	4,980 00	12,900 00	825 00	
Raising berme bank, near lock No. 50	6,000	July 14, 1869	Dec. 1, 1869	6,000	4,925 00	700 00	1,240 00	3,685 00	
Filling packet-boat basin, at Syracuse	3,000	July 14, 1869	Dec. 1, 1869	3,000	1,360 00	1,060 00	1,060 00	300 00	
Protecting highway, etc., at De Ruyter reservoir	6,000	July 14, 1869	Dec. 1, 1869	6,000	5,425 00	4,060 00	4,060 00	1,365 00	
Rebuilding iron bridge at Warren street, Syracuse	11,000	July 14, 1869	Dec. 1, 1869	11,000	9,963 00	5,560 00	5,560 00	4,403 00	
Rebuilding iron bridge at Lock street, Syracuse	7,000	July 14, 1869	Dec. 1, 1869	7,000	8,080 00	7,580 00	7,580 00	500 00	
Straightening Chittenango creek channel	5,000	July 14, 1869	Dec. 1, 1869	....	....	....	....	....	Belongs to repair cont'ct.
Removing waste-weir at Cowasselon cr'k	21,000	July 14, 1869	Apr. 1, 1870	....	....	....	....	....	Belongs to repair cont'ct.
Removing wall benches on Jordan level	18,005	July 14, 1869	Apr. 1, 1870	....	....	....	....	....	Belongs to repair cont'ct.
Removing wall benches on Jordan level	61,995	....	....	61,995	61,995 00	21,815 00	21,815 00	40,180 00	Contract of Canal Com'r.
Removing wall benches on Syracuse level	47,000	July 14, 1869	Apr. 1, 1870	47,000	47,000 00	17,300 00	17,300 00	29,700 00	
Removing wall benches on Long level	28,000	July 14, 1869	Apr. 1, 1870	28,000	28,000 00	14,640 00	14,640 00	13,360 00	
Rebuilding culvert near Burdick's bridge	3,000	Sep. 23, 1869	Apr. 1, 1870	3,000	3,685 00	3,020 00	3,020 00	665 00	
Wall and receiver at discharge weigh-lock sewer	11,000	Sep. 23, 1869	Apr. 1, 1870	....	....	....	....	....	Not awarded.
Bottoming down east of lock No. 47	40,000	....	....	....	....	....	....	....	Given to repair contrac'r, act c. 877, Laws of 1869.
Inserting iron needle-beams in bridge at Chittenango	1,420	Aug. 3, 1870	Sep. 1, 1870	1,420	802 00	....	....	802 00	
Rebuilding of iron turnpike bridge over feeder at Orville	1,560	Aug. 3, 1870	Nov. 1, 1870	1,560	1,050 40	....	....	1,050 40	
Inserting iron needle-beams in bridge at Centreport	1,500	Aug. 3, 1870	Sep. 1, 1870	1,500	1,111 00	....	....	1,111 00	
Slope wall on towing-path side, Nine-mile Creek feeder	6,000	Aug. 3, 1870	May 1, 1871	6,000	3,397 50	....	....	3,397 50	
Rebuilding iron bridge over Durston's dry dock, Syracuse	600	Aug. 3, 1870	Sep. 1, 1870	....	....	....	....	....	Belongs to repair cont'ct.
Overfall and paved waste at outlet, De Ruyter reservoir	15,742	Aug. 3, 1870	Nov. 1, 1870	11,500	6,143 00	....	....	6,143 00	
Raising Geddes' road at Syracuse	15,000	Aug. 3, 1870	Nov. 1, 1870	15,000	10,116 00	....	....	10,116 00	
Swing bridge at Higginsville	2,500	Mar. 8, 1870	Apr. 15, 1870	2,500	3,679 87	3,679 87	3,679 87	Settled.	
Ditch on berme bank, near Canastota	500	May 2, 1870	Sep. 1, 1870	500	500 00	500 00	500 00	Settled.	
				$276,475	$253,957 77	$108,834 87	$134,294 87	$119,662 90	

TABLE No. 2—(Continued).

OSWEGO CANAL.

CHARACTER OF WORK.	Appropriation.	When let.	When to be completed.	Engineer' estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.	Remarks.
Stone dam at Minetto, Oswego river	$106,100	Nov. 14, 1866	Dec. 1, 1867	$106,100	$76,565 00	$9,540 00	$58,500 00	$18,065 00	Incre'd by Canal B. $11,700
High dam, Oswego river	50,000	July 14, 1869	Nov. 1, 1870	111,000	70,584 00	12,560 00	12,560 00	58,024 00	
Berme bank, Oswego river	180,000	Aug. 13, 1864	April 1, 1868	180,000	176,016 44	2,716 44	176,016 44	Settled.	
Bulkhead at Farwell's mill	4,000	July 14, 1869	April 1, 1870	4,000	4,000 00	3,420 00	3,420 00	580 00	
Deepening Oswego river at Oswego	40,000	July 14, 1869	Dec. 1, 1869	41,500	36,600 00			36,600 00	
Vertical wall on enlargem'nt secti'n No. 4	4,000	July 14, 1869	April 1, 1870	4,000	4,000 00	3,780 00	3,780 00	220 00	
Raising banks, etc., of Oswego canal	31,000	July 14, 1869	Dec. 1, 1869	31,000	23,570 00	12,160 00	12,160 00	9,410 00	
Rebuilding docks on side-cuts at Salina	25,000	July 14, 1869	Dec. 1, 1869	25,000	19,750 00	9,400 00	9,400 00	10,350 00	
Iron bridge at First street, Fulton	4,000	July 14, 1869	Dec. 1, 1869	4,000	2,925 60	2,925 60	2,925 60	Settled.	
Iron bridge at Division street, Syracuse	3,400	July 27, 1869	Dec. 1, 1869	3,400	3,468 75	3,460 00	3,460 00	8 75	
Iron bridge at Bear street, Syracuse	3,326	Aug. 3, 1870	Sept. 1, 1870						Belongs to rep'r contract.
Iron bridge at Durston's dry dock, Syracuse		Aug. 3, 1870	Sept. 1, 1870						Belongs to rep'r contract.
Iron foot bridge at Lodi street, Salina	2,300	Aug. 3, 1870	Sept. 1, 1870						Belongs to rep'r contract.
Iron bridge at Cold Spring	7,000	July 14, 1869	Dec. 1, 1869	7,000	4,716 00	4,620 00	4,620 00	96 00	
Culvert near Haskins' salt block, below Salina	21,620	Feb. 4, 1870	April 1, 1870	21,620	22,174 00	780 00	780 00	21,394 00	
Total				$538,620	$444,369 79	$65,362 04	$289,622 04	$154,747 75	

CHENANGO CANAL.

CHARACTER OF WORK.	Appropriation.	When let.	When to be completed.	Engineer' estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.
Rebuilding lock No. 18	$11,901	Jan. 5, 1869	Apr. 20, 1869	$11,901	$11,901 07	$11,901 07	$11,901 07	Settled.
Rebuilding lock No. 19	13,160	Jan. 5, 1869	Apr. 20, 1869	13,160	13,159 99	13,159 99	13,159 99	Settled.
Rebuilding lock No. 22	20,697	Jan. 5, 1869	Apr. 20, 1869	20,697	20,696 72	20,696 72	20,696 72	Settled.
Rebuilding lock No. 105	10,000	Oct. 16, 1865	Apr. 1, 1866	10,000	6,701 00			$6,701 00
Rebuilding lock No. 106	9,000	Oct. 16, 1865	Apr. 1, 1866	9,000	5,747 00			5,747 00
Rebuilding lock No. 107	12,500	Oct. 16, 1865	Apr. 1, 1866	12,500	9,669 00			9,669 00
Swing bridge at Canal street, Norwich	3,000	Sept. 23, 1869	Apr. 1, 1870	3,000	2,499 53	2,499 53	2,499 53	Settled.
Swing bridge at Genesee street, Greene								
Iron bridge at Genesee street, Greene	5,000	Sept. 23, 1869	Apr. 1, 1870	5,000	3,884 50			3,884 50
Swing bridge at Henry st., Binghamton	2,000	July 1, 1870	Sept. 15, 1870	2,000	1,998 25			1,998 25
Iron bridge at Court st, Binghamton	7,945	Aug. 3, 1870	Nov. 1, 1870	7,945	5,722 50			5,722 50
Total				$95,203	$81,979 56	$48,257 31	$48,257 31	$33,722 25

CAYUGA AND SENECA CANAL.

Pier at Geneva	$20,837	July 22, '68	Dec. 1, '68	$20,837	$17,754 15	$8,754 15	$17,754 15	Settled.	Inc'd by Canal B'd $837.
Rebuilding locks Nos. 2, 3, 9 and 11	37,000	July 14, '69	April 1, '70	37,000	39,446 00	29,900 00	29,900 00	$9,546 00	
Dredging channel, etc., at Cayuga inlet, at Ithaca	15,000	Sept. 23, '69	Sept. 1, '70	12,000	9,775 00	3,280 00	3,280 00	6,495 00	
Iron bridge at Ovid street, Seneca Falls	7,000	Sept. 23, '69	April 1, '70	5,800	7,000 00	4,980 00	4,980 00	2,020 00	
Iron needle beams in bridges at Geneva and Waterloo	3,000	July 27, '69	Nov. 1, '69	3,000	3,357 15	3,357 15	3,357 15	Settled.	
Vertical wall on berme at Seneca Falls	3,000	May 1, '70	Sept. 1, '70	1,787	1,787 17	1,787 17	1,787 17	Settled.	Cont. of Canal Com'rs.
Swing bridge near lock No. 11	2,070	Mar. 8, '70	April 15, '70	2,070	1,800 00	1,260 00	1,260 00	540 00	
Iron bridge at Canal street, Waterloo	3,700	Mar. 8, '70	April 15, '70	3,700	2,907 20	2,907 20	2,907 20	Settled.	
	....	... .	....	$86,194	$83,826 67	$56,225 67	$65,225 67	$18,601 00	

CHEMUNG CANAL.

Dredging from lock No. 1 to Seneca lake	$15,000	Sept. 23, '69	Sept. 1, '70	$15,300	$11,850 00	$5,100 00	$5,100 00	$6,750 00	
Cleaning out State ditch on farm of M. Sayre, etc.	4,700	July 14, '69	Dec. 1, '69	4,700	4,367 90	3,520 00	3,520 00	847 90	
Raising and extending breakwater at Watkins	20,000	Aug. 2, '70	Nov. 1, '70	20,000	16,575 00	....	....	16,575 00	
Taking up old lock and constructing culvert, etc., at Elmira	7,000	Aug. 2, '70	Nov. 1, '70	7,000	4,050 00	....	....	4,050 00	
	....	....	....	$47,000	$36,842 90	$8,620 00	$8,620 00	$28,222 90	

BALDWINSVILLE CANAL.

Iron bridge at Bridge st., Baldwinsville	$6,500	July 14, '69	Dec. 1, '69	$6,500	$5,432 70	$3,912 70	$5,432 70	Settled.	
Total	....	....	....	$6,500	$5,432 70	$3,912 70	$5,432 70	....	

STATEMENT showing engineer's estimate, estimated cost at contract prices, estimated cost at prices fixed under Laws of 1869 *and* 1870, *amount done and remaining to be done, and amount done during fiscal year.*

ONEIDA LAKE CANAL.

CHARACTER OF WORK.	Amount appropriated.	When let.	When to be completed.	Engineer's estimate.	Estimated cost at old contract prices from original estimated quantities.	Estimated cost at old contract prices from present estimated quantities.	Estimated cost at prices fixed by canal board and board of canal commissioners under Laws of 1869 and 1870.	Amount done.	Amount remaining to be done.	Amount done during fiscal year.
Section No. 1	$346, 153 47	Dec. 18, '67	July 1, '69	$306, 000 00	$32, 500 00	$37, 000 00	$50, 000 00	$37, 960 00	$12, 040 00	$16, 900 00
Section No. 2		Dec. 18, '67	July 1, '69		46, 000 00	58, 000 00	68, 000 00	62, 900 00	5, 100 00	35, 020 00
Section No. 3		Dec. 18, '67	July 1, '69		56, 000 00	64, 000 00	74, 000 00	52, 200 00	21, 800 00	32, 240 00
Section No. 4		Dec. 18, '67	July 1, '69		55, 500 00	66, 000 00	96, 000 00	79, 400 00	16, 600 00	41, 980 00
Section No. 5		Dec. 18, '67	July 1, '69		68, 000 00	94, 000 00	128, 000 00	98, 300 00	29, 700 00	73, 300 00
Totals	$346, 153 47	....	....	$306, 000 00	$258, 000 00	$314, 000 00	$416, 000 00	$330, 760 00	$85, 240 00	$199, 440 00

TABLE No. 2—(Continued).

EXTENSION OF THE CHENANGO CANAL.

Length in Chains.	CHARACTER OF WORK.	Appropriation.	When let.	When to be completed.	Engineer's estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.	Remarks.
62	Section No 1	......	June 22, '65	Sept. 1, '66	$7,878 89	$7,878 89	....	$7,878 89	....	Canceled October, 1867.
....	Section No. 1	......	June 29, '68	April 1, '70	14,690 00	11,711 93	$3,681 93	11,711 93	....	Completed.
33	River bank or towing-path sec'n	......	July 14, '69	Nov. 1, '70	34,000 00	18,000 00	8,860 00	8,860 00	$9,140 00	
71	Section No. 2	......	June 22, '65	Sept. 1, '66	29,086 87	29,086 87	....	29,086 87	....	Canceled October, 1867.
....	Section No. 2	......	July 29, '68	April 1, '70	60,471 50	54,029 00	23,760 00	46,820 00	7,209 00	Relet.
80	Section No. 3	......	June 22, '65	Sept. 1, '66	30,385 72	30,385 72	....	30,385 72	....	Canceled October, 1867.
....	Section No. 3	......	July 29, '68	April 1, '70	6,020 89	6,020 89	60 89	6,020 89	....	Canceled Nov., 1869, and attached to section 4.
80	Section No. 4	......	June 22, '65	Sept. 1, '66	40,523 61	40,523 61	....	40,523 61	....	Canceled October, 1867.
....	Section No. 4	......	July 29, '68	April 1, '70	90,255 50	89,893 00	22,060 00	62,360 00	27,533 00	Relet.
90	Section No. 5	......	June 22, '65	Sept. 1, '66	57,485 02	57,485 02	....	57,485 02	....	Canceled October, 1867.
....	Section No. 5	......	July 29, '68	April 1, '70	29,900 00	24,745 00	14,565 00	23,225 00	1,520 00	Relet.
90	Section No. 6	......	June 22, '65	Sept. 1, '66	39,227 81	39,227 81	....	39,227 81	....	Canceled October, 1867.
....	Section No. 6	......	July 29, '68	April 1, '70	10,593 89	10,593 89	....	10,593 89	....	Canceled June, 1869.
....	Section No. 6 and part of 7	......	July 14, '69	Nov. 1, '70	35,880 00	31,119 00	17,300 00	17,300 00	13,819 00	Relet.
80	Section No. 7	......	June 22, '65	Sept. 1, '66	43,095 00	31,726 85	....	31,726 85	....	Completed.
80	Section No. 8	......	June 22, '65	Sept. 1, '66	21,185 00	29,626 93	....	29,626 93	....	Completed.
80	Section No. 9	......	June 22, '65	Sept. 1, '66	12,745 00	19,427 52	....	19,427 52	....	Completed.
80	Section No 10	......	June 22, '65	Sept. 1, '66	6,692 62	6,692 62	....	6,692 62	....	Canceled October, 1867.
....	Section No. 10	......	July 29, '68	April 1, '70	13,100 00	15,556 29	3,476 29	15,556 29	....	Completed.
76	Section No. 11	......	Feb. 7, '66	Sept. 1, '67	30,650 00	28,048 89	....	28,048 89	....	Completed.
81	Section No. 12	......	Feb. 7, '66	Sept. 1, '67	17,050 00	18,500 86	....	18,500 86	....	Completed.
80	Section No. 13	......	Feb. 7, '66	Sept. 1, '67	12,130 00	8,284 47	....	8,284 47	....	Completed.
80	Section No. 14	......	Feb. 7, '66	Sept. 1, '67	13,080 16	13,080 16	....	13,080 16	....	Canceled October, 1867.
....	Section No. 14	......	July 29, '68	April 1, '70	10,210 00	9,222 72	....	9,222 72	....	Completed.
80	Section No. 15	......	Feb. 7, '66	Sept. 1, '67	9,008 86	9,008 86	....	9,008 86	....	Canceled October, 1867.
....	Section No. 15	......	July 29, '68	April 1, '70	10,850 00	6,939 80	....	6,939 80	....	Completed.
80	Section No. 16	......	Feb. 7, '66	Sept. 1, '67	22,650 00	13,455 68	....	13,455 68	....	Completed.
82	Section No. 17	......	Feb. 7, '66	Sept. 1, '67	18,430 45	18,430 45	....	18,430 45	....	Canceled October, 1867.
....	Section No. 17	......	July 29, '68	April 1, '70	25,700 00	13,946 98	686 98	13,946 98	....	Completed.
88	Section No. 18	......	Feb. 7, '66	Sept. 1, '67	36,311 34	36,311 34	....	36,311 34	....	Canceled October, 1867.
....	Section No, 18	......	July 29, '68	April 1, '70	46,098 00	46,098 00	31,138 00	46,098 00	....	Canceled June, 1870.
80	Section No. 19	......	Feb. 7, '66	Sept. 1, '67	10,650 00	11,280 50	....	11,280 50	....	Completed.
86	Section No. 20	......	Feb. 7, '66	Sept. 1, '67	40,952 23	39,777 23	14,477 23	39,777 23	....	Completed.
80	Section No. 21	......	June 15, '66	May 1, '67	10,830 46	10,830 46	....	10,830 46	....	Canceled October, 1867.
....	Section No. 21	......	July 29, '68	April 1, '70	44,700 00	44,320 94	27,100 94	44,320 94	....	Completed.
79	Section No 22	......	June 15, '66	May 1, '67	65,100 00	76,271 86	....	76,271 86	....	Completed.
85	Section No. 23	......	June 15, '66	May 1, '67	12,050 00	29,219 55	....	29,219 55	....	Completed.

TABLE No. 2—(Continued).

Length in Chains.	CHARACTER OF WORK.	Appropriation.	When let.	When to be completed.	Engineer's estimate.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.	Remarks.
79	Section No. 24	......	June 25, '66	May 1, '67	$9,369 20	$9,369 20	....	$9,369 20	....	Canceled.
....	Section No. 24	......	Nov. 11, '69	Nov. 1, '70	45,000 00	30,972 50	....	....	$30,972 50	Relet.
82	Section No. 25	......	June 15, '66	May 1, '67	3,426 79	3,426 79	....	3,426 79	....	Canceled October, 1867.
...	Section No. 25	......	Nov. 11, '69	Nov. 1, '70	22,000 00	9,512 00	$2,520 00	2,520 00	6,992 00	Relet.
84	Section No. 26	......	June 15, '66	May 1, '67	108,455 66	108,455 66	....	108,455 66	....	Canceled October, 1867.
80	Section No. 27	......	June 15, '66	May 1, '67	10,528 51	10,528 51	....	10,528 51	....	Canceled October, 1867.
....	Section No. 26 and 27	......	Sept. 23, '69	Nov. 1, '70	73,000 00	64,402 00	15,040 00	15,040 00	49,362 00	Relet.
85	Section No. 28	......	June 25, '66	May 1, '67	16,700 00	16,520 00	....	....	16,520 00	Old Contract.
85	Section No. 29	......	June 25, '66	May 1, '67	10,910 01	10,910 01	....	10,910 01	....	Canceled October, 1867.
87	Section No. 30	......	June 15, '66	May 1, '67	5,005 28	5,005 28	....	5,005 28	....	Canceled October, 1867.
....	Section No. 29 and 30	......	Nov. 11, '69	Nov. 1, '70	24,000 00	16,370 00	....	....	16,370 00	Relet.
80	Section No. 31	......	Feb. 11, '70	April 1, '71	16,650 00	10,050 00	....	....	10,050 00	
80	Section No. 32	......	Feb. 11, '70	April 1, '71	17,200 00	10,886 00	....	....	10,886 00	
80	Section No. 33	......	Feb. 11, '70	April 1, '71	19,200 00	10,107 00	....	....	10,107 00	
80	Section No. 34	......	Feb. 11, '70	April 1, '71	18,400 00	10,605 00	....	....	10,605 00	
80	Section No. 35	......	Feb. 11, '70	April 1, '71	23,600 00	12,574 00	....	....	12,574 00	
80	Section No. 36	......	Feb. 11, '70	April 1, '71	22,850 00	15,913 00	....	....	15,918 00	
115	Section No. 37	......	Feb. 11, '70	April 1, '71	25,950 00	15,353 00	....	....	15,353 00	
136	Section No. 38	......	Feb. 11, '70	April 1, '71	80,725 00	59,198 00	....	....	59,198 00	
....	Raising towing-path on sections Nos. 12, 13, 16, 22 and 23	......	July 14, '69	Nov. 1, '70	18,000 00	11,880 00	8,500 00	11,880 00	....	
....	Lock No. 1	......	June 22, '65	Sept. 1, '66	1,933 78	1,933 78	....	1,933 78	....	Canceled.
....	Lock No. 2	......	June 22, '65	Sept. 1, '66	2,876 90	2,876 90	....	2,876 90	....	Canceled and abandoned.
....	Lock No. 3	......	June 22, '65	Sept. 1, '66	1,772 50	1,772 50	....	1,772 50	....	Canceled.
....	Lock No. 1 and 3	......	Nov. 11, '69	Nov. 1, '70	81,730 00	35,694 00	3,000 00	3,000 00	32,694 00	Relet.
....	Lock No. 4	......	Feb. 7, '66	Sept. 1, '67	4,457 34	4,457 34	....	4,457 34	....	Canceled October, 1867.
....	Lock No. 4	......	July 14, '69	Nov. 1, '70	18,000 00	11,000 00	3,460 00	3,460 00	7,540 00	Relet.
....	Lock No. 5	......	Feb. 7, '66	Sept. 1, '67	12,995 00	13,879 16	1,199 16	13,879 16	....	Completed.
....	Lock No. 6	......	July 14, '69	Nov. 1, '70	20,000 00	13,000 00	5,740 00	5,740 00	7,260 00	
....	Lock No. 7 and 8	......	Sept. 23, '69	Nov. 1, '70	31,000 00	23,879 00	8,700 00	8,700 00	15,179 00	
...	Choconut aqueduct	......	Feb. 7, '66	Sept. 1, '67	17,007 16	17,007 16	....	17,007 16	....	Canceled October, 1867.
....	Choconut aqueduct	......	July 14, '69	Nov. 1, '70	35,000 00	37,166 10	19,200 00	26,600 00	10,566 10	Relet
....	Tracy aqueduct	......	Feb. 7, '66	Sept. 1, '67	30,000 00	34,438 05	19,438 05	34,438 05	....	Completed.
....	Apalachin aqueduct	......	Feb. 7, '66	Sept. 1, '67	35,000 00	31,000 00	4,840 00	26,940 00	4,060 00	Canceled Oct., 1867; rescinded.
....	Archibald aqueduct	......	Nov. 11, '69	Nov. 1, '70	15,000 00	9,097 00	1,440 00	1,440 00	7,657 00	
....	Culverts on sect's. Nos. 1 to 5	......	June 22, '65	Sept. 1, '66	444 44	444 44	....	444 44	....	Canceled October, 1867.
....	Culverts on sect's. Nos. 6 to 10	......	June 22, '65	Sept. 1, '66	12,511 40	12,511 40	....	12,511 40	....	Canceled October, 1867.
....	Culverts on sect's. Nos. 11 to 20	......	Feb. 7, '66	Sept. 1, '67	17,738 85	17,738 85	....	17,738 85	....	Canceled October, 1867.
....	Culverts on sect's. Nos. 1 to 20	......	July 29, '68	April 1, '70	18,250 00	25,640 50	10,560 00	22,780 00	2,860 50	Relet.
....	Culverts on sect's. Nos. 21 to 30	......	June 15, '66	May 1, '67	55,000 00	52,843 00	13,780 00	39,380 00	13,463 00	Old contract.
....	Bridges on sect's. Nos. 1 to 5	......	June 22, '65	Sept. 1, '66	4,113 40	4,113 40	....	4,113 40	....	Canceled.

....	Bridges on sect's. Nos. 6 to 10,	......	June 22, '65	Sept. 1, '66	4,263 46	4,263 46	....	4,263 46	....	Canceled.
....	Bridges on sect's. Nos. 1 to 10;	......	July 14, '69	Nov. 1, '70	23,000 00	16,000 00	4,720 00	4,720 00	11,280 00	Relet.
....	Bridges on sect's. Nos. 11 to 23,	......	July 14, '69	Nov. 1, '70	39,000 00	32,000 00	9,640 00	10,340 00	21,660 00	
....	Bridges on sect's. Nos. 24 to 30,	......	Nov. 11, '69	Nov. 1, '70	28,000 00	17,369 00	380 00	380 00	16,989 00	
....	Binghamton dam and guard lock..................	......	Nov. 11, '69	Nov. 1, '70	100,000 00	69,459 00	4,484 71	4,484 71	64,974 29	
....	Pea Island dam	......	Feb. 11, '70	April 1, '71	75,000 00	53,665 00	....	....	53,665 00	
	Total......................	....	....	....	$2,219,233 00	$1,971,546 08	$303,759 18	$1,377,574 69	$593,971 39	

TABLE No. 3.

STATEMENT of authorized work upon miscellaneous repairs, under the supervision of the Engineer department, for the fiscal year ending September 30th, 1870.

ERIE CANAL.

CHARACTER OF WORK.	How authorized.	Appropriation or engineer's estimate.	Amount done.	Amount paid.	Remarks.
Inserting iron needle beams in bridge at Brutus street, Weedsport	By Commissioner upon change of plan.	$1,578 42	$1,697 22	$1,578 42	Old structure deducted.
Inserting iron needle beams in bridges at William, McBride and Clinton streets, Syracuse, and at Genesee street, Geddes	By Commissioner upon change of plan.	4,842 15	5,297 55	4,842 15	Old structure deducted.
Inserting iron needle beams in bridge at Peterboro st., Canastota	By Commissioner upon change of plan.	960 10	1,057 30	960 10	Old structure deducted.
Inserting iron needle beams in bridge at Crane brook, and Dougherty bridge, in Port Byron	By Commissioner upon change of plan.	2,005 32	2,198 82	2,005 32	Old structure deducted.
Repairs of breach in stone dam at Skaneateles	By Commissioner under repair contract.	12,935 49	12,998 19	12,935 49	
Rebuilding and setting back berme abutment and constructing iron bridge at Basin street, Geddes	By Commissioner upon change of plan.	5,036 85	5,959 28	5,036 85	Materials and old structure deducted.
State ditch, extending from Erie canal northerly into Owasco creek	Act chap. 877, Laws of 1866	1,785 00	1,785 00	1,785 00	
Protecting banks on section 7, by refilling with brush and stone	By Commissioner upon change of plan.	9,286 90	11,397 50	9,286 90	To refill with earth deducted.
Bottoming down east of Lock 47	Act chap. 877, Laws of 1869	40,000 00	36,465 87	34,340 62	Earth above original bottom deducted.
Removing waste-weir, etc., at Cowassalon creek	By Commissioner under repair contract.	21,000 00	19,300 00	19,300 00	
Removing wall-benches on the Jordan level	By Commissioner under repair contract.	18,005 00	18,005 00	18,005 00	
			$116,161 73		

OSWEGO CANAL.

CHARACTER OF WORK.	How authorized.	Appropriation or engineer's estimate.	Amount done.	Amount paid.	Remarks.
Inserting iron needle beams in bridges at James street, Syracuse, and Salina and Park streets, Salina	By Commissioner upon change of plan.	$4,171 56	$4,551 36	$4,171 56	Old structure deducted.
Inserting new iron beams in bridge at First st., Fulton	By Commissioner under repair contract.	639 75	676 29	639 75	Materials delivered deducted.
			$5,227 65		

CAYUGA AND SENECA CANAL.

CHARACTER OF WORK.	How authorized.	Appropriation or engineer's estimate.	Amount done.	Amount paid.	Remarks.
Renewing floor joists in bridges at Geneva and Waterloo	By Commissioner under repair contract.	$497 84	$640 08	$497 84	Old structure deducted.

CHENANGO CANAL.

Raising the feeder banks at Oxford	By Canal Board under repair contract	$900 00	$900 00	$900 00
Rebuilding the aqueduct at New Hartford	By Commissioner under repair contract.	33, 989 15	33, 989 15	33, 989 15
			$34, 889 15	

CHEMUNG CANAL.

Repairing dam at Gibson		$62, 226 60	$62, 226 60	$62, 226 60

TABLE No. 4.

STATEMENT showing the work not under contract.

EXTENSION OF CHENANGO CANAL.

CHARACTER OF WORK.	Engineer's estimate.	Remarks.
Four wooden locks, including Guard lock	$91,573 00	
Wappasena aqueduct	25,000 00	
Little Wappasena aqueduct	20,000 00	
Ellis aqueduct	25,000 00	
Culverts on sections Nos. 31 to 38 inclusive	38,000 00	
Bridges " " "	44,200 00	
Total	$243,773 00	

SUMMARY.

Amount of work done during the fiscal year.

CANALS.	Work under contract.	Work upon miscellaneous repairs.	Totals.
Erie, including Otisco Lake reservoir	$108,834 87	$116,161 73	$224,996 60
Oswego	65,362 04	5,227 65	70,589 69
Cayuga and Seneca	56,225 67	640 08	56,865 75
Chemung	8,620 00	62,226 60	70,846 60
Chenango	48,257 31	34,889 15	83,146 46
Oneida Lake (enlargement)	199,440 00	....	199,440 00
Baldwinsville	3,912 70	....	3,912 70
Chenango extension	303,759 18	....	303,759 18
	$794,411 77	$219,145 21	$1,013,556 98

WESTERN DIVISION.

ANNUAL REPORT OF DANIEL RICHMOND, DIVISION ENGINEER, WESTERN DIVISION, NEW YORK STATE CANALS, FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1870.

Division Engineer's Office, Western Division,
Rochester, *September* 30, 1870.

Hon. Van R. Richmond, *State Engineer and Surveyor:*

Sir.—In pursuance of the regulations of the engineer department, under act, chap. 169, Laws of 1862, I herewith submit my annual report of the Western Division of the New York State canals for the fiscal year ending September 30, 1870.

The canals embraced in this division are as follows, viz.:

	Miles.
Erie canal, from east line of Wayne county to Buffalo	148½
Genesee Valley canal, from Rochester to Millgrove	113½
Dansville branch of Genesee Valley canal	11
Total	273

The navigable feeders are as follows:

	Miles.
Genesee River feeder at Rochester	2¼
" " " at Oramel	¾
Total	3

The canals on this division are supplied with water from the following sources:

ERIE CANAL.

Lake Erie.

Tonawanda creek at Pendleton.

Genesee Valley canal at Rochester.

Genesee river at Rochester.

GENESEE VALLEY CANAL.

Allen's creek at Scottsville.
Genesee river at Mount Morris.
Canaseraga creek feeder, two miles north of Dansville.
Mill creek at Dansville.
Wiscoy creek feeder.
Genesee river at Oramel.
Rockville reservoir, near Belfast.
Two branches of Black creek on Summit level.
Oil creek reservoir on Summit level, two miles north of Cuba.
Champlain and Griffin creeks at Cuba.
Ischua feeder, from Ischua creek at south end of Summit.
Oil creek feeder at foot of lock No. 101.
Haskell creek on extension.
Dodge creek on extension at Portville.
Oswayo creek on extension south of Portville.
Allegany river at head of canal at Millgrove.

ENGINEER DEPARTMENT.

The Western Division for the past year has been under the charge of the undersigned as Division Engineer, and J. Nelson Tubbs as Resident Engineer.

In table No. 1, hereto annexed, will be found a list of engineers employed for the fiscal year, both in ordinary and extraordinary repairs, together with a statement of the time of service and rate of compensation of each.

Table No. 2, also annexed, shows the character and condition of the work under contract during the year, and table No. 3 the character and condition of work of a miscellaneous character, done under the supervision of this department.

Quite an amount of the engineering expenses included in table No. 1, was in payment for work done in making and revising plans and supervising the thorough reconstruction and repairs of old and dilapidated structures, and taking cross sections for bottoming out of completed canals, and such part is properly chargeable to ordinary repairs.

The amount of work done on this division during the fiscal year, under the supervision of this department, as shown by tables Nos. 2 and 3, and not including ordinary repairs under contract or done by superintendent, is as follows;

Erie canal	$284,548 16
Genesee Valley canal	186,837 56
Total	$471,384 72

The amount expended for engineering is $32,159.55.

The cost of engineering, therefore, equals $6\frac{8}{10}$ per cent of the whole amount done.

ERIE CANAL.

Ordinary Repairs.

All of the sections on this division of the Erie canal were under contract for repairs until the first day of April last, when the contracts for sections Nos. 12 and 13 were canceled by the Canal Board, on application of the contractors, in pursuance of act, chapter fifty-five, Laws of 1870. The remaining sections, Nos. 10, 11 and 14, were not canceled, and still remain in charge of the contractors. It was very late in the spring before much work could be done in the bottom of the canal; but as soon as the weather permitted, vigorous measures were adopted on the whole line to put the prism of the canal and all the structures below water in good repair. The extraordinary exemption from breaks and detention during the season tells the story of the success of these efforts. The universal expression of both forwarders and boatmen is, that the canal has afforded facilities for rapid and uninterrupted transit almost unexampled in its history. Although never partial to the superintendent system (so called) of keeping the canals in repair, and still believing that it is not the best that can be devised, nor the one which will be permanently adopted in the future, yet I am satisfied from the developments of the past season that it is greatly superior to the system by contract which it has superseded, and although the expense for the past season has been large, yet I believe the work in the main has been economically done; and the canal shows unmistakable tokens of the control and fostering care of a power which has a direct interest in its permanence and success. Much remains to be done on all the sections in clearing out the deposit and even considerable original material from the prism, and I am still of the opinion expressed in my last report, that the cheapest and most expeditious method of excavating this material is in the use of a sufficient number of steam dredges adapted to the purpose, working through the season of navigation, as the time in the spring during which the work can be prosecuted in the usual way is too short and labor too scarce and high to be very effective, even at large cost. Whether any one of the dredges now in use is the best that can be devised for this purpose I very much doubt, but that the inventive genius of our people should be quickened and directed into this channel by some means I am satisfied. One way in which I conceive this result could be accomplished, would be by the passage of a law authorizing the Canal Board to offer a suitable premium for the best style of steam dredge or excavator, complete and ready for use, the premium to be paid after suitable satisfactory tests made under the direction of a commission of competent men appointed by the said board.

The only detentions reported on this division are as follows:

One lower gate broken out at lock No. 64 on the 22d day of July; detention to navigation, thirty hours.

Leak around and under composite culvert on three mile level in Brighton, September 6th; detention, seventy-two hours.

The levels on the whole division have been very uniformly kept up to full height, and, as before remarked, navigation has been uninterrupted except in the cases and from the causes above specified. A large amount of work has been done on the several sections, both by superintendents and repair contractors, in raising and graveling towing-path, renewing coping timber on vertical walls, ditching on top and in rear of banks to carry off surface water, and in repairing and rebuilding bridges and other structures. Nearly all the bridges, which are not substantially new, have been put in good repair. Although a few will have to be built new next season, some of the most important should be constructed of iron.

I would respectfully state, as my opinion, that that provision of act, chap. 55, Laws of 1870, providing for the appointment of patrolmen by the Canal Board, should be repealed, and for the reason that the superintendent, under the direction of the Canal Commissioner in charge already under previous laws, has authority to employ a sufficient number of men to perform the duties required of patrolmen under this act; and it may be reasonably inferred that from his intimate knowledge of the parties likely to be applicants for these places on his section, and the facilities he possesses for making necessary inquiries in regard to them, he is as likely, to say the least, to select good men as under the present arrangement. In addition to this fact, I conceive it to be very important that the men employed for this duty should be more thoroughly under the control and direction of the superintendent, as they would be if appointed and subject to removal directly by him. If thought advisable, the same police powers could be given to these appointees as are given by the act above specified. I believe the plan proposed would lead to a more faithful and rigid discharge of duty than can now reasonably be expected or obtained under the present plan.

I would also respectfully repeat my suggestion of last year, that the Canal Commissioner in charge should, under the present system, be given authority to let the repairs of the more important and expensive pieces of work to the lowest bidder on such short, reasonable notice as may be deemed expedient, instead of having it done by days' labor by the superintendent. I believe that if the Canal Commissioner was clothed with sufficient authority, and this matter left to his option, that a considerable amount might be saved each year on every superintendent's section.

Extraordinary Repairs.

The following named contracts have been completed and settled during the year: Pile jetty pier at Black Rock; improving Main and Hamburgh Street canal; completing Clark and Skinner canal; dock along Howard Agricultural Works; removing 800 feet of division bank in Black Rock harbor; protecting docking of Ohio basin and deepening slip; inserting iron needle beams in bridges at West avenue, Rochester, and Main street, Brockport; vertical wall at Port Gibson; bridge abutments at Brockport; swing bridge at Rochester; iron bridge at Brockport; tow-path bridge at Macedon; iron bridge on Pittsford road; iron bridge at Market street, Palmyra; stop dam in Genesee River feeder; additional sluice culvert in town of Pendleton; raising tow-path and wall on section No. 368 and pier between canal and mill-race at Lockport.

The condition of the work on a large number of other contracts not yet completed is fully set forth in table No. 2.

The work of removing old bench walls between Lyons and Newark is about one-third completed, and will probably be finished the coming winter. The work of doubling the fourteen locks on this division has progressed during the season, and has consisted principally in the procuring and delivering the materials to be used in their construction; some masonry, however, has been laid at Lockville. It is confidently expected that most of the lock pits will be excavated previous to the opening of canal next season, and several of the double locks brought into use soon thereafter. The estimated cost of these locks is $526,000. By act, chapter 877, Laws of 1869, $200,000 was provided, and by act, chapter 767, Laws of 1870, $200,000 more, leaving $126,000 yet to be provided. It is believed, however, that this balance need not be provided the present winter.

The work of removing easterly bridge, in Palmyra, and constructing an additional roadway to next bridge west was commenced; but, before anything was done to the superstructure, the west bridge (which was of iron on Swartz plan) fell into the canal in consequence of a defect in the iron of one of the chords. The authority of the Canal Board having been obtained, a new, elegant and strong bridge of iron, on Whipple's plan, having two roadways and one sidewalk, has been erected.

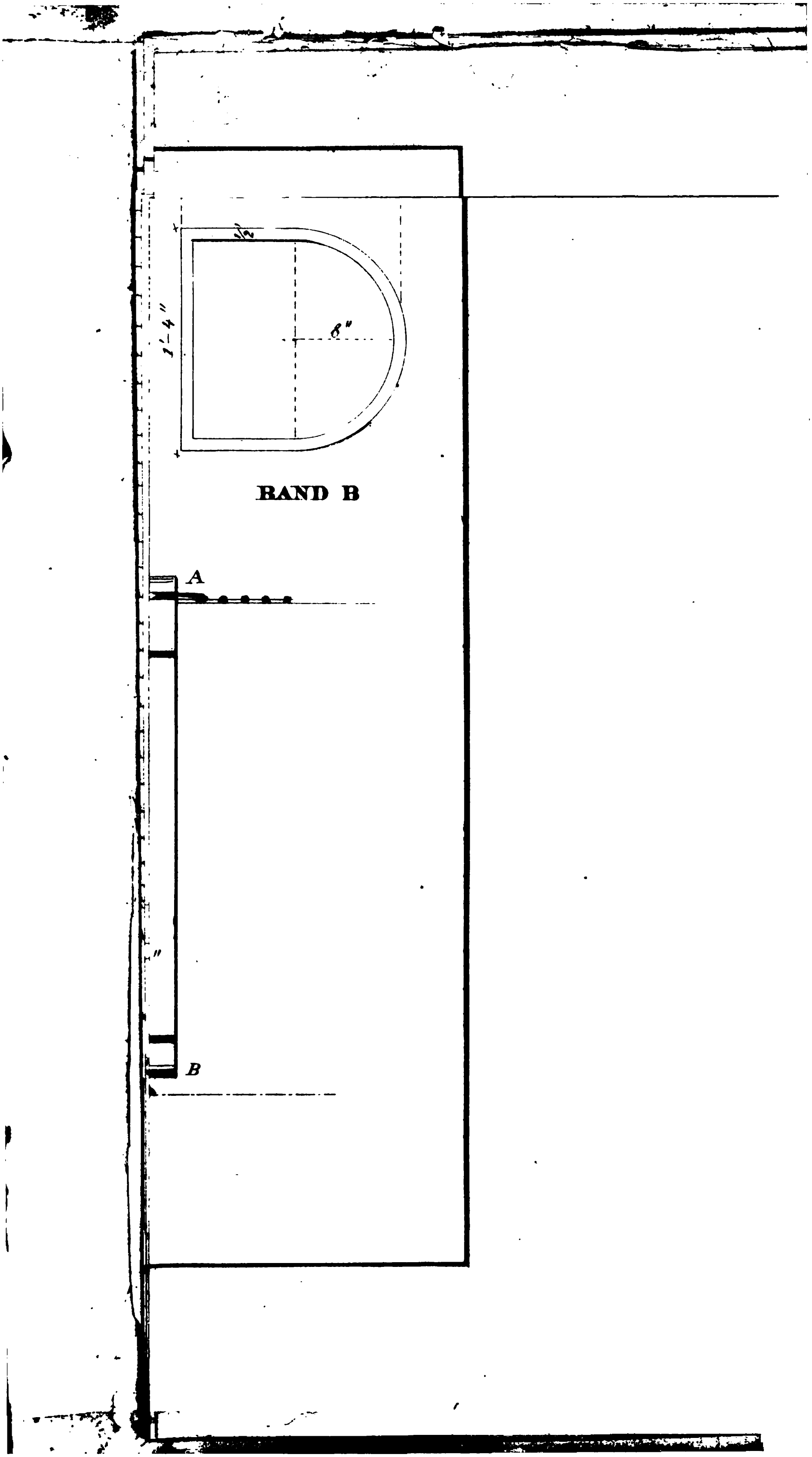
The work of constructing and testing the steam dredge on the plan and under the patent of B. & D. Hughes, authorized by act, chapter 767, Laws of 1870 is nearly completed at this date, but not sufficiently so as to enable such tests to be made as would settle the question of its utility and value for the purpose intended.

The swing bridge over the canal on Exchange street, in the city of Rochester, was completed early in the season. It has given great satisfaction to the citizens of Rochester, and they have very cheerfully submitted to inevitable and somewhat frequent short detentions while the bridge was open to pass boats.

The principal, and perhaps only objections to their general introduction in cities, is, first, the cost attending them, and, second, the addition of one more cause of obstruction to navigation to the many already existing, where much freight is shipped or transhipped at numerous warehouses, wood, lumber and coal yards and elevators. The bridge itself is of wrought-iron, and a strong and durable structure.

WORK RECOMMENDED TO BE DONE.

Act, chapter 767, Laws of 1870, authorized the deepening and improving the narrow canal in Black Rock harbor, and made an appropriation for that purpose of $80,000. The undersigned believes that whatever work is done at that point should be on the basis of an intelligent plan, embracing the final improvement of the canal channel for the full length of the harbor, so as to totally remove the causes of detention and complaint now constantly arising in the navigation of that part of the canal. The general plan of improvement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proposed may be understood by a brief statement. The canal channel from Erie street, in the city of Buffalo, to Buffalo and Niagara Falls railroad bridge, at the head of Black Rock harbor, is 150 feet wide at surface of water; from thence to a short distance below Ferry street the width of canal channel is only about seventy feet, with a broad channel between that and Niagara river leading to the lower end of the harbor, at which point are several large mills which are supplied with water from the harbor, and unless great care and watchfulness is used by the canal authorities, there is nothing to prevent water being abstracted directly from the canal for the use of the mills. In addition to these facts, it may be stated that most of the water which supplies the Erie canal from the city of Buffalo to Montezuma, a distance of nearly 150 miles, is passed through this narrow channel of seventy feet, causing at all times a current of great velocity, and rendering the towing of loaded boats through the canal west a matter of great difficulty and expense. I believe there are but two remedies for this difficulty; first, to purchase the rights of the mill owners on the harbor and use all the water for canal purposes, or, second, to remove the present division bank between the canal and harbor farther to the north, between the railroad bridge and Ferry street, and rebuild it so as to secure a canal channel of at least 120 feet in width, to correspond as nearly as may be to the width of the canal between the railroad bridge and Erie street, and eventually to put in a division bank from Ferry street to Black Rock guard lock, thus securing a canal channel of 150 feet between those points, and preventing the possibility of drawing any water directly from the canal for the use of the mills, leaving them an independent channel for procuring the necessary water. The estimated cost of the whole improvement is $350,000. The present construction, however, of that part of the improvement between the railroad bridge and a point thirteen and one-half chains east of Ferry street, a distance of about 5,700 feet, will accomplish a great and much needed improvement in the navigation through the harbor. I, therefore, respectfully recommend that an additional appropriation of $80,000 be made this winter, which, added to the $80,000 appropriated by act, chapter 767, Laws of 1870, for the improvement of the harbor, will provide a fund of $160,000, which, it is believed by the undersigned, will be sufficient for the work between the points named, and will make the improvement, so far as done, a part of the complete plan above described for the final improvement of the whole harbor.

On the twelve-mile level between Macedon and Newark, there is but one place besides Palmyra aqueduct near west end of level, where water can be discharged from the canal in case of danger or disaster, and that is through a large waste-weir in the village of Newark, near the east end of the level. This weir discharges into a small brook or creek, which runs for nearly half a mile through the village and once crosses the main street. It usually happens once or twice during the season that so large an amount of water is voided from the canal that the little creek channel has not sufficient capacity to carry it, and it overflows village lots, fills cellars and flows to a considerable depth over the main street of the village. The last Legislature made an appropriation of $1,000 for the purpose of deepening and otherwise improving this channel. I have made careful examinations and measurements of the work required and am satisfied that an additional appropriation of $2,000 will be required to remove the causes of this damage.

Recommendation has been made in several former reports that a culvert should be constructed under the canal, about half a mile west of the State ditch at Tonawanda. There was formerly a culvert at this point under the old canal, but which was taken out during the enlargement, and the necessary drainage sought to be accomplished by the construction of a small covered sewer extending from the point named, parallel with the canal and about 300 feet distant therefrom to the State ditch. This sewer was built with stone side-walls, laid dry and covered with plank. The structure is in so dilapidated a condition that it is now nearly useless, and there is consequently no drainage for a considerable tract of country south of the canal at that point. A culvert under the canal is what is desired by the residents there, and would most effectually and permanently accomplish the drainage. The estimated cost is $15,000. In case a culvert is not authorized, I conceive a thirty-inch cement pipe sewer properly constructed, to take the place of the old sewer, would temporarily furnish the required relief. The estimated cost of the pipe sewer is $3,000.

I would respectfully recommend an appropriation of $600 for the purpose of reconstructing the docking along the channel from ship lock at Black Rock to Niagara river, the same having become decayed and not included in the repair contract for section No. 14.

Act, chapter 281, Laws of 1869, authorized the construction of some vertical wall on berme side of canal at Macedon, at a cost of $4,600, but as no money was raised to pay for the work, it has not been built. The Legislature should provide the means to perform this work. I would recommend that there be included with it an appropriation of $800 for the purpose of constructing a permanent bridge across the discharge ditch constructed by the State at the foot of the tow-path approach of the main road bridge at Macedon, and for reducing the steep grade of said approach.

I estimate the amount which should be expended next year on this division for changing plans for bridges and inserting iron in place of wood beams, at $45,000.

By act, chapter 767, Laws of 1870, the sum of $3,000 was appropriated for the purpose of opening channel for surplus waters from culvert and waste-weir on Erie canal in the town of Royalton, county of Niagara. With this appropriation was coupled the proviso that it should only be expended when "all persons affected or damaged by the overflows in consequence of such surplus waters, shall execute to the Canal Commissioner in charge of the western division of the canals of this State, a good and sufficient release in writing for all claims for damages which they have existing against the State in consequence of such overflows."

The waste-weir alluded to discharges into east branch of Eighteen Mile creek, which runs for some miles between moderately bluff banks, when the surface of the country becomes smoother and less rolling. After reaching the flatter land the stream is very crooked, much choked with logs, weeds, etc., with small descent in the stream. It is unquestionable that if the stream was straightened at several points, and the balance thoroughly cleaned out for a distance of six or seven miles, the most of the damage caused by the flooding of lands would be removed; but this would be attended by a very large outlay. I made an examination of the points at which it is claimed damage accrues in consequence of the voiding of water from the canal with a view to determine whether such use could be made of the $3,000 appropriated as would induce persons claiming to be damaged, to execute the releases contemplated by the act. I found that an expenditure of at least $25,000 would be required to give such relief as is claimed by the land owners. As a consequence, the condition could not be complied with, and the money cannot be expended. As the result of the examination made, I would state that I am of the opinion that the estimate made by the claimants of the amount of damage resulting from the water added to the stream from the canal, is greatly exaggerated. And I am clearly of the opinion that if any relief is granted it should be only after a thorough examination, and a careful weighing of sworn statements, by the canal appraisers.

GENESEE VALLEY CANAL.

ORDINARY REPAIRS.

All of the sections of this canal, except section No. 2, were under the charge of contractors until the first of April last, when the balance of them were surrendered, and all have since been under the charge of superintendents. No detentions are reported on account of breaks or damage to the canal. Navigation has been uninterrupted and unimpeded, and the time consumed in making round trips has compared favorably with the best seasons in the history of this canal. These results are partly in consequence of a favorable season, but is also due to a very thorough system of repairs inaugurated in the spring and continued throughout the season, also to a careful husbanding of the water, proper attention to duty on the part of lock tenders, and constant watchfulness on the part of those in authority.

The manner in which the repairs of this canal have been conducted during the season, has given great satisfaction to forwarders and boatmen, and restored their confidence in its utility as an avenue in which to rely in conducting their business. The steam dredge has been employed for the most of the season in keeping open a channel at the slide bank near Portage, and has been successful in doing so. The crib towing-path at that point constructed in the spring has stood well.

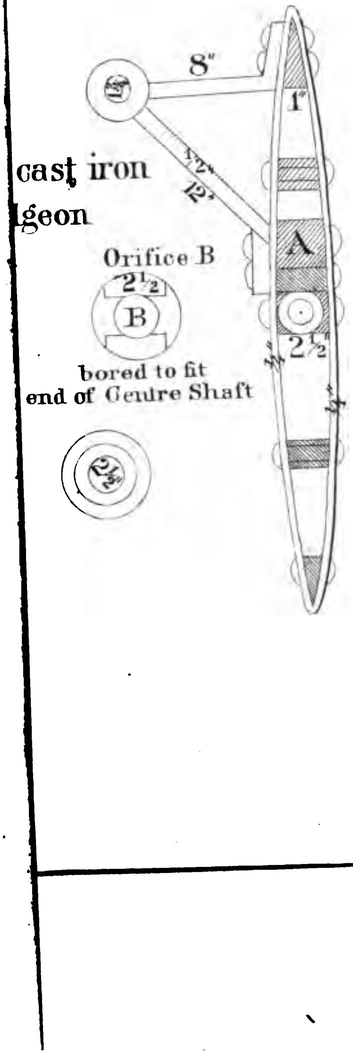
A very permanent dam has been constructed across Allen's creek, at Scottsville during the summer, which will last many years, and will give the State control of so much of the water in the creek as it is desirable to use for purposes of navigation. A new trunk was put in the upper aqueduct at Olean last spring, and the towing-path part of Genesee River aqueduct, at Portage renewed. The trunk of the Wiscoy aqueduct, and also of two others at Olean, will have to be renewed previous to opening of navigation next spring, and the dam across the Canaseraga creek, near Dansville, during the summer.

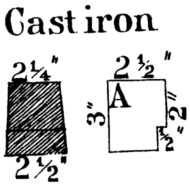
The work of bottoming out the canal, so vigorously prosecuted last spring, should be continued during the coming winter and spring.

BOILER PLATE VALVE

FOR

LOCK GATES





LITH. OF THE ARGUS CO. ALBANY, N.Y.

EXTRAORDINARY REPAIRS.

It will be seen by an examination of table No. 2, that a large number of contracts for work on this canal have been settled during the year. Of those yet remaining in force the most important are deepening, widening, and improving the canals, between the guard lock at the rapids and junction at Rochester, the securing slide bank, near Portage, and raising Oil Creek reservoir near Cuba. The first mentioned will, without doubt, be finished during the coming winter. It is also expected that so much will have been accomplished by next spring, on the securing the slide bank at Portage, as will place it in such a condition that navigation can be safely maintained thereafter by a small judicious expenditure by the superintendent, and that the contract can be closed. The work of raising Oil Creek reservoir will be completed by January first. It has been done in a very thorough, and, it is believed, permanent manner; and that with proper care exercised in the use of the water, will with the other sources provided, insure an ample supply at all seasons for the summit levels.

WORK RECOMMENDED TO BE DONE.

The east abutment of the very important Genesee River dam at Mount Morris, was originally constructed of timber, which is now decayed and must be rebuilt, as the structure is in danger from every flood. I earnestly recommend an appropriation of $13,000, to reconstruct the abutment of stone, and the renewal of the timber docking connected therewith at the head of same.

For protecting the canal against the encroachments of Genesee river at various points, and to settle for work now in progress on this canal, will require a further appropriation of $12,000.

During the dryest part of each season, great difficulty is experienced in procuring sufficient water to maintain navigation in the Dansville side cut. Having made examination, I am satisfied that a remedy for this scarcity may be found by opening a feeder channel, about one-quarter of a mile in length, into a small natural reservoir, about ten miles from Dansville, called Loon lake. This lake is about one mile long and one-third to one-half of a mile wide. It receives the drainage of quite an extent of surrounding country, and is also supplied by numerous springs in the bottom. To make this lake available as a source of supply to the canal in dry seasons, a feeder of about one-quarter of a mile in length will be required, from which point the water will pass down natural water courses to Mill creek, above the point where that stream is taken into the side cut. I am of the opinion that the State will not become liable for any damages in consequence of the improvement proposed. The estimated cost is $10,000.

FINAL SURVEYS.

A party has been employed a portion of the season, under the direction of Thomas Evershed, Esq., in making the first survey of the canal, from Lockport to Brockport. That portion of the work has been completed, and there now remains on the Erie canal only that portion from Black Rock to and through the city of Buffalo, including the slips, basins and canals yet to survey. This work will be prosecuted during the winter, as it can be more conveniently done during the suspension of navigation than at any other time. There has been expended in this work, during the fiscal year, $1,385. It is believed that the appropriation already made will complete the work on this division of the Erie canal. A final survey of the Genesee Valley canal should be made at an early day. When this work is commenced additional appropriations will be required.

RECAPITULATION OF APPROPRIATIONS RECOMMENDED TO BE MADE.

Erie Canal.

Deepening, widening, constructing division bank and otherwise improving narrow channel in Black Rock harbor.	$80,000
Improving and protecting discharge from waste-weir at Newark	2,000
Culvert under canal at Tonawanda	15,000
Or a pipe-sewer in line of culvert	3,000
Reconstructing docking along channal from Ship Lock at Black Rock into Niagara river	600
To pay for work authorized by act, chapter 281, Laws of 1869, and constructing permanent road-bridge across discharge ditch at foot of main road embankment at Macedon, and to improve the grade of said embankment	5,400
Changing plans of bridges and inserting iron in place of wood needle beams to iron bridges	45,000
Stop gate at Holley	3,000
Protecting and securing swing bridge at Ferry street	5,000

GENESEE VALLEY CANAL.

Reconstructing of stone the east abutment of Genesee River dam at Mount Morris and renewing the docking connected therewith	$13,000
To settle for work now under contract, and to protect canal at various points against enroachments of Genesee river	12,000
Making outlet for Loon lake, and so discharge its waters as to make them available as a feeder for the Dansville Side Cut canal	10,000

Respectfully submitted.

DANIEL RICHMOND,
Division Engineer, Western Division.

TABLE No. 1.

STATEMENT showing name, number of days and compensation of engineers upon the repairs of the Western Division of the New York State canals, together with incidental expenses, during the fiscal year ending Sept. 30, 1870, *under act, chap*. 169, *Laws of* 1863.

ERIE CANAL—REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amounts.	Totals.
Daniel Richmond	Division engineer	Salary	$2,400	$1,600 00	
Daniel Richmond	Division engineer	Travel	6c. per mile.	424 80	
J. Nelson Tubbs	Resident engineer	Salary	2,000	1,333 32	
J. Nelson Tubbs	Resident engineer	Travel	6c. per mile.	442 26	$3,800 38
Incidental expenses.					
Stationery				$266 79	
Fuel, light and office rent				495 46	
Postage and telegraph				210 49	
Miscellaneous				230 80	1,203 54
Total for Erie canal					$5,003 92

GENESEE VALLEY CANAL—REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amounts.	Totals.
Daniel Richmond	Division engineer	Salary	$2,400	$800 00	
Daniel Richmond	Division engineer	Travel	6c. per mile.	352 20	
J. Nelson Tubbs	Resident engineer	Salary	2,000	666 68	
J. Nelson Tubbs	Resident engineer	Travel	6c. per mile.	204 60	$2,023 48
Incidental expenses.					
Stationery				$161 53	
Fuel, light and office rent				212 59	
Postage and telegraph				136 19	
Miscellaneous				116 59	626 90
Total for Genesee Valley canal					$2,650 38

RECAPITULATION.

Erie canal	$5,003 92
Genesee Valley canal	2,650 38
Total	$7,654 30

TABLE No. 1—(Continued).

STATEMENT showing the assistants temporarily employed on ordinary repairs during the fiscal year ending Sept. 30, 1870, *and paid by the Canal Commissioners.*

ERIE CANAL—ORDINARY REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amounts.	Totals
George Arnoldt	Assistant engineer	22	$5 50	$121 00	
Camillus Weiss	Rodman	6	2 50	15 00	
Charles Bush	Chainman	7	2 00	14 00	
F. Warren	Axman	6	1 50	9 00	
S. Z. Quackenbush	Inspector	79	3 00	237 00	
					$396 00

GENESEE VALLEY CANAL—ORDINARY REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amounts.	Totals
H. V. B. Barker	Assistant engineer	202	$5 50	$1,111 00	
Byron Holley	Assistant engineer	54	5 50	297 00	
George Arnoldt	Assistant engineer	26	5 50	143 00	
N. F. Comstock	Leveler	156	4 50	702 00	
G. S. Boss	Rodman	156	3 00	468 00	
N. H. Briggs	Rodman	156	3 00	468 00	
George G. Russell	Flagman	79	2 75	217 25	
George G. Russell	Flagman	77	3 00	231 00	
H. V. B. Barker, Jr	Axman	10	2 00	20 00	
B. G. Lewis	Inspector	77	3 00	231 00	
					$3,888 25

RECAPITULATION.

Erie canal	$396 00
Genesee Valley canal	3,888 25
Total	$4,284 25

TABLE No. 1—(Continued).

STATEMENT showing the assistants temporarily employed on extraordinary repairs during the fiscal year ending September 30, 1870, *and paid by Canal Commissioner.*

ERIE CANAL—EXTRAORDINARY REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amount.	Total.
J. Frederick Behn	Assistant engineer	313	$5 50	$1,721 50	
Byron Holley	Assistant engineer	173	5 50	951 50	
George Arnoldt	Assistant engineer	197	5 50	1,083 50	
F. F. Curry	Assistant engineer	70	5 50	385 00	
F. F. Curry	Draughtsman	78	5 00	390 00	
John Bisgood	Draughtsman	245	5 00	1,225 00	
E. Knechling	Draughtsman	148	4 50	666 00	
L. Gardner	Leveler and surveyor	142	5 00	710 00	
N. F. Comstock	Leveler	22	5 00	110 00	
Alfred W. Barrett	Leveler	26	4 00	104 00	
Alfred W. Barrett	Assistant leveler	78	3 75	292 50	
Alfred W. Barrett	Assistant leveler	65	3 50	227 50	
Newton E. Story	Rodman	137	3 25	445 25	
Newton E. Story	Rodman	39	3 00	117 00	
R. B. McFarlin	Rodman	110	3 25	357 50	
R. B. McFarlin	Rodman	22	3 00	66 00	
E. A. Judd	Chainman	157	3 00	471 00	
T. T. Warren	Tapeman	22	2 50	55 00	
Gregory P. Ritt	Tapeman	18	2 50	45 00	
John Hausle	Inspector	79	4 00	316 00	
John Hausle	Inspector	52	3 50	182 00	
John Green	Inspector of masonry.	112	4 00	448 00	
John H. Boulton	Inspector of masonry.	132	4 00	528 00	
Ed. J. Green	Inspector of masonry.	29	3 00	87 00	
D. G. Bronson	Inspector of masonry.	79	3 00	237 00	
Jerome B. Ransom	Inspector of masonry.	134	3 00	402 00	
					$11,623 25
Erie canal				$11,623 25	
Genesee Valley canal				8,597 75	
					$20,221 00

GENESEE VALLEY CANAL—EXTRAORDINARY REPAIRS.

NAMES.	Nature of service.	No. of days.	Rate of compensation.	Amount.	Total.
Byron Holley	Assistant engineer	103	$5 50	$566 50	
George Arnoldt	Assistant engineer	119	5 50	654 50	
H. V. B. Barker	Assistant engineer	150	5 50	825 00	
F. F. Curry	Assistant engineer	9	5 50	49 50	
John Bisgood	Draughtsman	69	5 00	345 00	
E. Knechling	Draughtsman	52	4 50	234 00	
L. Gardner	Leveler and surveyor	170	5 00	850 00	
N. F. Comstock	Leveler	28	5 00	140 00	
N. F. Comstock	Leveler	78	4 50	351 00	
Alfred W. Barrett	Leveler	53	4 00	212 00	
Alfred W. Barrett	Assistant leveler	77	3 75	288 75	
Alfred W. Barrett	Assistant leveler	14	3 50	49 00	
Newton E. Story	Rodman	37	3 25	120 25	
Newton E. Story	Rodman	40	3 00	120 00	
R. B. McFarlin	Rodman	116	3 25	377 00	
R. B. McFarlin	Rodman	57	3 00	171 00	
N. E. Briggs	Rodman	117	3 00	351 00	
G. S. Boss	Rodman	117	3 00	351 00	
G. G. Russell	Flagman	157	3 00	471 00	
L. H. Spencer	Inspec'r of mec. struc.	313	5 00	1,565 00	
Amos Soper	Inspector	83	3 00	249 00	
M. W. Cole	Inspector	79	2 75	217 25	
M. W. Cole	Inspector,	16	2 50	40 00	
					$8,597 75

SUMMARY OF TABLE No. 1:

Showing engineering expenses for fiscal year ending Sept. 30, 1870.

NAME OF CANAL.	Engineering proper.	Incidental expenses.	Amount.	Total.
Repairs proper, Erie canal	$3,800 38	$1,203 54	$5,003 92	$7,654 30
Repairs proper, Genesee Valley canal	2,023 48	626 90	2,650 38	
Repairs ordinary, Erie canal......	396 00	....	$ 396 00	4,284 25
Repairs ordinary, Genesee Valley canal...	3,888 25	....	3,888 25	
Repairs extraordinary, Erie canal.........	11,623 25	....	$11,623 25	20,221 00
Repairs extraordinary, Gen. Valley canal..	8,597 75	....	8,597 75	
Total	....	....	....	$32,159 55

TABLE No. 2.

STATEMENT showing character of work, estimated cost at engineer's and contract prices, the amount done during the fiscal year ending September 30, 1870, and the amount remaining to be done on work under contract on the Western Division.

ERIE CANAL.

CHARACTER OF WORK.	Engineer's estimate, with engineering and contingencies added.	Estimated cost at contract prices.	Amount done during fiscal year.	Total amount done.	Amount remaining to be done.
Dredging Ohio basin	$18,000 00	$18,000 00	$8,280 00	$17,640 00	$660 00
Pile jetty pier at Black Rock	7,000 00	6,572 68	1,572 68	6,572 68	Settled.
Extending Black Rock pier	10,000 00	10,000 00	2,700 00	5,800 00	4,200 00
Improving Main and Hamburgh Street canal	15,000 00	11,004 28	1,644 28	11,004 28	Settled.
Completing Clark and Skinner canal, Buffalo	20,000 00	15,471 19	471 19	15,471 19	Settled.
Deepening and improving Narrow canal in Black Rock harbor	78,000 00	78,000 00	....	....	78,000 00
Improving and widening canal and constructing vertical wall between Erie and Commercial streets, Buffalo	30,000 00	30,000 00	....	....	30,000 00
Protecting canal against encroachments of Lake Erie	75,000 00	75,000 00	....	....	75,000 00
Constructing dock along Howard Agricultural works, Main and Hamburgh Street canal	3,295 24	3,295 24	3,295 24	3,295 24	Settled.
Raising and re-coping Black Rock pier	10,000 00	10,000 00	8,700 00	8,700 00	1,300 00
Extending, raising and strengthening division bank at Lower Black Rock	5,000 00	5,000 00	....	....	5,000 00
Improving and completing Main and Hamburgh Street canal	15,000 00	15,000 00	1,600 00	1,600 00	13,400 00
Dredging channel around north end of Erie basin breakwater	17,500 00	17,500 00	13,440 00	14,140 00	3,360 00
Removing deposit from Black Rock harbor	30,000 00	28,000 00	8,110 00	9,560 00	18,440 00
Removing 800 feet of division bank in Black Rock harbor	10,000 00	9,452 72	9,452 72	9,452 72	Settled.
Removing abutments and superstructure of old bridge and constructing new iron bridge over slip leading to river lock at Tonawanda	5,800 00	5,800 00	....	....	5,800 00
Vertical wall on guard lock section and clearing out mill race at Black Rock	19,500 00	19,500 00	....	....	19,500 00
Protecting docking of Ohio basin and deepening slip	5,000 00	4,392 46	2,042 46	4,392 46	Settled.
Removing old warehouse foundation at Black Rock	3,200 00	2,807 43	1,440 00	2,640 00	167 43
Doubling guard lock at Black Rock	47,000 00	45,000 00	6,200 00	6,200 00	38,800 00
Iron bridge over Ohio basin slip on Fulton street, Buffalo	6,500 00	6,000 00	5,140 00	5,140 00	860 00
Iron bridge on Georgia street, Buffalo	12,000 00	12,000 00	9,140 00	9,140 00	2,860 00
Inserting iron needle beams in bridges on Ferry, Genesee, Prime and Michigan streets	10,000 00	9,500 00	....	....	9,500 00
Inserting iron needle beams in bridges on Washington st., Main and Hamburgh St. canal	2,000 00	2,000 00	....	....	2,000 00
Inserting iron needle beams in two bridges at Clyde, three at Lyons and two at Newark	6,800 00	5,500 00	4,220 00	4,220 00	1,280 00
Inserting iron needle beams in bridges at Palmyra, Macedon and Port Gibson	2,300 00	2,300 00	....	....	2,300 00
Inserting iron needle beams in bridges on West av., Rochester, and Main st., Brockport	2,000 00	1,872 03	1,872 03	1,872 03	Settled.
Inserting iron needle beams in bridges at Comstocks, Adams, Millards, Hindsburgh and Shelby street	8,000 00	7,800 00	4,200 00	4,200 00	3,600 00
Iron bridge at Orangeport	3,300 00	3,200 00	....	....	3,200 00
Iron bridge at McCarty's	2,800 00	2,500 00	....	....	2,500 00
Iron bridge at Maybees	3,300 00	3,000 00	....	....	3,000 00
Wrought-iron swing bridge at Albion and two iron bridges at Brockville and county line	16,500 00	16,000 00	....	....	16,000 00

Removing easterly bridge at Palmyra and constructing additional iron roadway to bridge on Main street	10,000 00	9,800 00	8,000 00	8,000 00	1,800 00
Timber bridge over waste-weir channel near Cartersville	1,095 29	1,095 29	840 00	840 00	255 29
Vertical wall at Port Gibson	3,000 00	1,814 24	454 24	1,814 24	Settled.
Vertical wall at Pendleton	3,500 00	3,500 00	....	....	3,500 00
Vertical wall near Shelby basin	2,000 00	2,000 00	....	....	2,000 00
Vertical and slope wall at Eagle harbor	4,000 00	3,400 00	....	....	3,400 00
Vertical wall at Reynales basin	2,000 00	2,000 00	....	....	2,000 00
Vertical wall between third and fourth locks east of Rochester	2,000 00	1,800 00	....	....	1,800 00
Removing bench walls and constructing slope and pavement wall between Lyons and Lockville	60,000 00	55,000 00	12,220 00	12,220 00	42,780 00
Raising and improving Sulphur Spring guard lock	11,000 00	10,500 00	....	....	10,500 00
Doubling Clyde lock	34,000 00	33,000 00	860 00	860 00	32,140 00
Doubling Lock Berlin lock	37,000 00	36,000 00	6,220 00	6,220 00	29,780 00
Doubling Lyons lock	35,000 00	34,000 00	760 00	760 00	33,240 00
Doubling poor-house lock	40,000 00	38,000 00	1,800 00	1,800 00	36,200 00
Doubling lower lock at Lockville	35,000 00	33,500 00	8,700 00	8,700 00	24,800 00
Doubling middle lock at Lockville	36,000 00	34,500 00	9,960 00	9,960 00	24,540 00
Doubling upper lock at Lockville	37,000 00	35,000 00	18,200 00	18,200 00	16,800 00
Doubling Lower Macedon lock	40,000 00	39,000 00	1,820 00	1,820 00	37,180 00
Doubling Pittsford lock	34,000 00	33,000 00	1,200 00	1,200 00	31,800 00
Doubling Miller's lock	35,000 00	34,000 00	3,920 00	3,920 00	30,080 00
Doubling lock No. 3, east of Rochester	39,000 00	37,500 00	....	....	37,500 00
Doubling lock No. 2, east of Rochester	39,000 00	37,500 00	....	....	37,500 00
Doubling lock No. 1, east of Rochester	38,000 00	36,000 00	3,300 00	3,300 00	32,700 00
Bridge abutments for bridge to connect Perry and Smith streets, Brockport	3,000 00	2,344 60	324 60	2,344 60	Settled.
Swing bridge on Exchange street, Rochester	8,800 00	8,800 00	580 00	8,800 00	Settled.
Iron bridge at Brockport	9,000 00	7,344 47	7,344 47	7,344 47	Settled.
Receiver for White's creek near Wayneport	3,000 00	2,800 00	....	....	2,800 00
Constructing tow-path bridge near Macedon	2,460 13	2,460 13	2,460 13	2,460 13	Settled.
Iron bridge on Pittsford road	3,000 00	2,444 41	2,444 41	2,444 41	Settled.
Iron bridge on Market street, Palmyra	5,000 00	4,997 66	4,997 66	4,997 66	Settled.
Stop dam at junction of Genesee River feeder and Erie canal	2,000 00	1,767 06	1,767 06	1,767 06	Settled.
Additional sluice culvert at Pendleton	4,000 00	2,986 76	2,986 76	2,986 76	Settled.
Additional sluice culvert at Lockport	4,000 00	3,000 00	260 00	260 00	2,740 00
Stop gate between Spencerport and Adams' basin	10,000 00	8,500 00	....	....	8,500 00
Stop gate between Deep Hollow culvert and wide water	10,000 00	8,500 00	....	....	8,500 00
Changing towing-path and improving line of canal along high clay bluff	2,500 00	2,500 00	600 00	600 00	1,900 00
Deepening Erie canal from First lock to Lyell street, Rochester	57,000 00	56,000 00	38,000 00	38,000 00	18,000 00
Ditch to drain lands of Thomas McGuire	1,500 00	1,300 00	....	....	1,300 00
Improving channel way and discharge culvert of Thomas creek	4,500 00	3,000 00	1,620 00	1,620 00	1,380 00
Waste-weir on three-mile level in Brighton	2,000 00	2,000 00	....	....	2,000 00
Improving and protecting discharge from Newark waste-weir	1,000 00	1,000 00	....	....	1,000 00
Constructing and testing steam canal dredge	20,000 00	20,000 00	15,500 00	15,500 00	4,500 00
Raising towing-path and wall of section 368, Black Rock	7,900 14	7,900 14	7,900 14	7,900 14	Settled.
Pier between the canal and mill-race at head of locks at Lockport	1,500 00	1,337 54	1,337 54	1,337 54	Settled.
Bridge over channel from Cartersville waste-weir on road leading to Bushnell's basin	1,000 00	....	1,000 00	1,000 00	Commuted.
Protecting lands of A. P. Seaman from wash of waste-weir channel	2,000 00	....	2,000 00	2,000 00	Commuted.
Total	....	....	$262,897 61	....	$865,642 72

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